DOCTOR OF PHILOSOPHY

Choosing referring expressions

Fukumura, Kumiko

Award date:
2010

DOCTOR OF PHILOSOPHY

Choosing referring expressions

Kumiko Fukumura

2010

University of Dundee

Choosing referring expressions

Kumiko Fukumura

School of Psychology
University of Dundee

Choosing referring expressions

Kumiko Fukumura

School of Psychology
University of Dundee

Submitted for the Degree of Ph.D.
School of Psychology, University of Dundee

June 2010

Contents

List of Tables

List of Figures

Acknowledgements

First, I am grateful for Trevor Harley, my supervisor, and Martin Pickering, my external advisor, who have been very supportive and inspiring throughout my PhD. Second, I am grateful for Roger van Gompel, who has also worked with me as a collaborator and provided me with invaluable insights and guidance. I would also like to thank Mark Oreilly and Jamie Pearson for checking some of the materials used in Chapters 4 and 6. Finally, I would like to thank the School of Psychology, University of Dundee, for their financial support.

Chapter 3 (Visual salience) is based on the paper published by Fukumura, Van Gompel, and Pickering (2010, *Quarterly Journal of Experimental Psychology*) with minor modifications. At the time of submission of this thesis, Chapter 5 (Addressee's discourse model) is based on a manuscript currently under review (*Topics in Cognitive Science*) and the manuscript that Chapter 6 (Animacy) is based on is under revision (*Language and Cognitive Processes*). Both Chapters 3 and 6 have benefited from comments of reviewers.

Declaration

I am the author of this thesis. Unless otherwise stated, all references cited have been consulted by myself, and the thesis reports experiments that I have conducted and has not been previously accepted for a higher degree.

I declare that the conditions of the relevant Ordinance and Regulations have been fulfilled.

Summary

This thesis focuses on the issue of how language users refer to an entity during discourse production, by investigating representations and processes that underlie the choice between pronouns and repeated noun phrases. Past research has shown that the use of pronouns (relative to more explicit expressions) is affected by the referent's salience in the prior linguistic context, but much less is known about how non-linguistic context affects the referent's salience and the choice of expression. Recent research has suggested that the referent's non-linguistic salience has no effect on the choice of pronouns and names (Arnold & Griffin, 2007). One of the major findings of the research reported in this thesis is that the referent's salience in the visual context plays an important role in the form of reference: Pronouns were less frequent (relative to repeated noun phrases) when the competitor was present than absent in the visual context. My second major finding is that similarity-based interference affects the choice of referring expressions. Pronouns are less frequent when discourse entities are similar in terms of their inherent conceptual properties as well as extrinsic properties, suggesting that the more similar the competitor to the referent, the stronger the interference, reducing pronoun usage. My third major finding is that contrary to many linguistic theories that assume that speakers choose referring expressions that are optimally helpful for their addressee (Ariel, 1990; Clark & Marshall, 1981; Givón, 1983), speakers do not choose expressions by adopting the addressee's discourse model: Pronouns are more frequent when the referent is salient to the speaker, not to the addressee. I argue that the explicitness of referring expressions is affected by the degree of conceptual access that is needed to initiate production processes: The more conceptual access is needed, the more elaborate expressions tend to be produced.

Overview of the thesis

When people speak, they can express a similar meaning in many different ways. For instance, to express the event of John hitting Mary, we can use different sentence structures, an active structure *John hit Mary* or a passive structure, *Mary was hit by John* (e.g., Bock, 1986; Bock & Warren, 1985) as well as different expressions to refer to the characters. John and Mary can be referred to not only by proper names but also pronouns such as *he, she* or definite noun phrases like *the man, the woman*. This thesis focuses on the latter choice language users have to make in communication. How do speakers or writers choose a particular referring expression amongst alternatives and what factors determine their preference to select one form over alternatives? Understanding how people choose a particular referring expression is important because it will tell us about the psychological processes and representations that underlie language production.

Research has found that speakers do not choose referring expressions randomly. For example, following an utterance such as *John scared Mary because…*, speakers often do not repeat the same referring expressions to refer to the main character (*John*) (e.g. *John scared Mary because John was shouting loudly.*), but instead they tend to use less explicit referring expressions such as pronouns (e.g., *John scared Mary because he was speaking loudly*). However, when referring to a less prominent character (e.g., Mary in the above example), people tend to use a repeated name more frequently (e.g. *John scared Mary because Mary was exceptionally timid*) (e.g., Arnold, 2010; Fukumura & Van Gompel, 2010; Stevenson, Crawley, & Kleinman, 1994). Thus, one of the most common assumptions, shared between both linguists (e.g., Ariel, 1990; Chafe, 1994; Givón,

1983a; Gundel, Hedberg, & Zacharski, 1993; Prince, 1981) and psycholinguists (e.g., Almor, 1999; Gordon, Grosz, & Gilliom, 1993; Sanford & Garrod, 1981), is that speakers choose referring expressions depending on the referent's prominence or salience in the discourse context. When the referent is highly salient and its representation is therefore highly accessible in the language user's discourse representation, less explicit referring expressions such as pronouns tend to be used, whereas when the referent is less salient or accessible, more explicit referring expressions such as names and definite noun phrases tend to be used. Chapter 1 will review linguistic theories that have modelled the distribution of referring expressions in relation to the referent's prominence in the discourse and will discuss the key psycholinguistic research that has identified the factors that determine what referring expressions language users tend to prefer under different discourse contexts.

Another major assumption commonly held amongst theories of reference is that speakers choose referring expressions to help the addressee's comprehension. Inspired by Grice's (1975) pragmatic theory, many linguistic theories have assumed that the *informativeness* or *explicitness* of a referring expression is affected by the speaker's assumption about the addressee's knowledge and cognitive status during the conversation: Speakers choose specific referential forms (e.g., pronouns, definite noun phrases) depending on how salient or familiar they assume the referent is to the addressee (Ariel, 1990; Chafe, 1994; Clark & Marshall, 1981; Givón, 1983), and there is a bulk of evidence that suggests that speakers are sensitive to the needs of their addressee (e.g., Brennan & Clark, 1996; Horton & Keyar, 1996; Horton & Gerrig, 2002; 2005b; Isaacs & Clark, 1987; Wilkes-Gibbs & Clark, 1992). Chapter 2 discusses theories and studies that have investigated to what extent and how speakers take into account the addressee's comprehension during reference.

OVERVIEW

As Chapter 1 will reveal, research has identified properties of the linguistic context that affect the choice of referring expressions, including textual distance from the prior mention of the referent (Ariel, 1990; Givón, 1983), number of competitors mentioned in the narrative and the preceding sentence (Clancy, 1980; Fletcher, 1984), semantic distance from the prior mention of the referent (Anderson, Garrod, & Sanford, 1983) and grammatical role or sentence position in the preceding sentence (Arnold, 2001; Brennan, 1995; Gordon et al., 1993; Fukumura & Van Gompel, 2010; Stevenson et al., 1994). However, it has been unclear whether the referent's salience in the non-linguistic context influences the choice of referring expressions. A recent experiment by Arnold and Griffin (2007) has suggested that the use of pronouns is affected by the referent's salience in the linguistic context, but not by its salience in the visual context. Chapter 3 will report two experiments that investigated the impact of the presence or absence of a competitor in the visual context in the choice of referring expressions.

In Chapter 4, I will focus on possible mechanisms that underlie ambiguity avoidance. One possible mechanism of avoiding ambiguous referring expressions is to evaluate whether the to-be-produced referring expression rules out reference to the competitor. However, researchers have recently argued that the active modelling of ambiguity is too resource-demanding for speakers to routinely engage in (Arnold & Griffin, 2007; Ferreira, Slevc, & Rogers, 2005), so there must be an alternative mechanism that is available for speakers to use. Arnold and Griffin (2007) suggested that speakers of English use pronouns less frequently when the context contains another entity that has the same gender as the referent, not necessarily because they are aware that the pronoun is ambiguous but because the same gender competitor is more similar to the referent than a different gender competitor. Entities that are

similar to the referent interfere with production processes more than those that are dissimilar, making the referent less accessible. However, so far, there is no clear evidence that similarity between discourse entities affects the choice of referring expressions, because in previous experiments, when the entities were similar (e.g., because they both had the same gender or they were the same category exemplars), the referring expressions were ambiguous, so the effect of similarity can be explained as ambiguity avoidance. Thus, the experiments in Chapter 4 examined if the choice of pronouns and definite noun phrases is affected by similarity in affordances in the visual context. When describing a king's action (e.g., getting off a horse), do speakers produce more definite noun phrases and fewer pronouns when the competitor can afford the same action because he or she is in the same situation (e.g., he or she is also on a horse) even though pronouns are unambiguous?

Chapter 5 addresses the issue of whether speakers take into account the addressee's discourse model when choosing referring expressions. So far, almost all psycholinguistic studies that investigated the issue of audience design used a referential context that involved ambiguity. However, theories of reference (Ariel, 1990; Chafe, 1994; Givón, 1983a) assume that audience design is not limited to situations where audience design is necessary for avoiding ambiguity. They claim that when the referent is assumed to be low in salience in the addressee's model, speakers produce more explicit referring expressions. To test their theory, the experiments in Chapter 5 examined if speakers take into account whether the referent is salient in the addressee's discourse model by manipulating whether the addressee heard an earlier reference to the competitor.

Past research has primarily focused on how the referential context influences the referent's salience and hence the choice of expression. However, such focus on

referential context raises the question of whether the referent's salience is determined by the properties of the referential context or whether the referent's inherent properties also have an effect. In Chapter 6, three experiments examined how the referent's animacy, a factor that is independent from the referential context (Bock, Loebell, & Morey, 1992; Dahl & Fraurud, 1996), affects the choice of pronouns and definite noun phrases.

The final chapter, Chapter 7, will summarise and discuss the major findings from my thesis.

Discourse prominence

People do not choose referring expressions such as pronouns and full noun phrases randomly. Many linguists have suggested that there is a systematic pattern in how people refer to a particular entity that they have in mind (i.e., *the referent*). What they have commonly observed is that the explicitness or specificity of referring expression is related to the referent's prominence in the discourse context (Ariel, 1990; Givón, 1983a; Gundel, Hedberg, & Zacharski, 1993; Prince, 1981). That is, when the referent is highly prominent in the discourse and hence the information about it is highly accessible in the language user's mental representation, semantically less constraining referring expressions such as pronouns tend to be used, whereas when the referent is less prominent and hence its representation is less accessible, semantically more constraining referring expressions such as definite noun phrases and names tend to be used. This chapter will review major theories of reference that have explained the form of reference based on the concept of accessibility and discuss the findings of psycholinguistic research that has examined linguistic variables that affect salience and accessibility.

Accessibility theories

Through cross-linguistic observations, Givón (1983a; 1989; 1992) indentified the following textual factors that appear to correlate with various linguistic decisions language users make, including the choice of referring expressions, sentence structure and the use of prosodic emphasis.

a) *referential distance* between the previous mention in the discourse and the current occurrence.
b) *potential interference* from the presence of a semantically compatible ("most commonly in terms of animacy, humanity, agentivity or semantic plausibility as the subject or the object", Givón, 1983a, p.14) referential competitor in the immediately preceding discourse.
c) *availability of semantic information within the clause*, which affects the plausibility of the referent
d) *availability of semantic information within the discourse* that predicts subsequent mention

Givón (1983a) argued that these factors influence the form of reference, because they all influence an entity's *topicality* or *accessibility to the addressee*. For instance, referential distance has an effect, because the more recently the referent has been mentioned in the prior discourse, the more topical or accessible it is in the addressee's mind. Similarly, the presence of a referential competitor matters, because it affects the referent's accessibility. That is, speakers choose linguistic expressions or structures to signal how topical or accessible the referent is to the addressee.

According to Givón (1983a), different referring expressions are ordered along a continuum of topic continuity or accessibility (Table 1). Zero anaphora (e.g., *Ø got the prize*.) are used when topic continuity is highest, whereas constructions such as right-dislocated definite noun phrases (e.g., *He got the prize, John did.*), non-dislocated neutral noun phrases (e.g., *John got the prize.*) and left-dislocated definite

noun phrases (e.g., *John, he got the prize.*) are used when topic continuity is at intermediate levels. Y-moved noun phrases, or grammatical objects that are contrastively topicalised (e.g., *I saw John there. Mary I never saw.*), are more continuous than cleft/focus constructions (e.g., *It was John who got the prize.*) and indefinite noun phrases (*A student got the prize.*), which are the lowest in topic continuity.

Table 1. *Topic accessibility hierarchy by Givón (1983a, p.17) with examples*[1]

most continuous/accessible topic
↕ zero anaphora ((he came in) and Ø sat down.)
unstressed/bound pronouns or grammatical agreement ((he came in;) *he* then sat down.)
stressed/independent pronouns ((she came in;) then *hé* joined her.)
R-dislocated definite noun phrases (*He* never joined, *the man*.)
neutral-ordered definite noun phrases ((the woman came in;) then *the man* joined her.)
L-dislocated definite noun phrases (now *the man, he* never joined.)
Y-moved NP's ('contrastive topicalization') (*The man,* she saw him.)
Cleft/focus construction (It was *the man* that joined her.)
Referential indefinite NPs (*A* man joined her.)
most discontinuous/inaccessible topics

Across many different languages, Givón and his colleagues found that referential distance is correlated with the use of particular anaphoric expressions. In spoken English (Givón, 1983b), for instance, the antecedents of 86% of pronouns were found one or two clauses back from the anaphor, whereas only 27% of definite noun phrases had an antecedent that occurred one or two clauses back. In contrast, pronouns were found to refer extremely rarely (1%) to an entity mentioned more

[1] The examples are taken from Givón (1983a), except for a few categories, where I added examples based on his scheme. Examples for some categories are unavailable in English in Givón (1983a) and are therefore not included in the scale.

than 15 clauses back, while definite noun phrases referred fairly commonly (46%) to an entity mentioned more than 15 clauses back. In analyses of spoken Japanese, grammatical subjects were expressed by zero anaphors (or ellipses) 86% of the time and by full noun phrases and pronouns 11% and 3% of the time respectively. Consistent with the accessibility hierarchy, the pattern of their distribution was found to be related to referential distance. The average referential distance for ellipsis was 1.6 clause, whereas the referential distances for full noun phrases and pronouns were much longer, 13.1 clauses and 12.3 clauses respectively (Hinds, 1983).

A similar approach was taken by Ariel (1988; 1990; 2001), who also assumed that all referring expressions are arranged on a single scale of accessibility, as in Table 2, and different referring expressions are used to signal the referent's accessibility to the addressee, thereby facilitating his or her memory retrieval about it.

Ariel assumed that the referent's accessibility is determined by how *salient* the referent is in the discourse context and the referent's salience is affected by multiple factors including the referential distance from previous mention. Her corpus analyses showed that when referring to an entity mentioned in the same sentence, pronouns (93%) were much more likely to be used compared to demonstrative descriptions (3%) and definite descriptions (3%). When anaphors referred back to the antecedent occurring in the preceding sentence, the use of pronouns, demonstratives and definite descriptions were 82%, 13% and 5% respectively. Pronoun use declined further when the anaphor referred back to the antecedent in a separate paragraph (48%), while the frequency of definite descriptions went up (41%) and the use of demonstratives was reduced only slightly (11%), suggesting that as the referential distance increases, the likelihood of pronoun use decreases, while the use of other

more explicit referring expressions increases. Furthermore, although both definite descriptions and full proper names tend to refer to distant entities (e.g., hardly any of the referents had a linguistic antecedent within the same sentence), full names were more likely to refer to an entity mentioned in a separate paragraph than definite descriptions, supporting the view that full names are lower accessibility marker than definite descriptions.

Table 2. *Accessibility hierarchy by Ariel (1990, p. 73) with examples.*[2]

low accessibility
full name + modifier (*Joan Smith, the president*)
full ('namy') name (*Joan Smith*)
long definite description (*The first woman selected to be on the team of an American spaceship*)
short definite description (*the president*)
last name (*Smith*)
first name (*Joan*)
distal demonstrative + modifier (*that hat we bought last year*)
proximal demonstrative + modifier (*this hat we bought last year*)
distal demonstrative (+ NP) (*That hat*)
proximal demonstrative (+ NP) (*This hat*)
stressed pronoun + gesture (Who's *hé*? (with a nod or other gesture))
stressed pronoun (Who's *hé*?)
unstressed pronouns (*What is he* doing?)
cliticized pronoun
extremely high accessibility markers (gaps, *wh* traces, reflexives, and agreement) (*e.g.,* What is he doing? Ø Taking photographs. /Here's some syrup for you. Shake Ø before using. /John pulled the blanket over *himself*.)
high accessibility

[2] The examples are taken from Ariel (1990). Examples for some categories are unavailable in English in Ariel (1990) and are therefore not included in the scale.

In addition to referential distance, Ariel posited three major factors that affect the accessibility of the referent. First, she argued that *competition* or the number of competitors in the prior linguistic context has an effect: The antecedent is more accessible when the context has fewer referential competitors (Arnold & Griffin, 2007; Clancy, 1980; O'Brien & Albrecht, 1991). Second, *saliency* of the antecedent, which is primarily determined by whether it is a topic or not, affects accessibility and the form of reference, though it is not entirely clear what Ariel means by being a "topic" or a "non-topic". Third, she also argued that *unity* or whether the antecedent is within the same episode or event (Anderson, Garrod, & Sanford, 1983) has an effect.

Another well-known hierarchy was proposed by Gundel et al. (1993), who assumed that the form of reference is determined by the referent's cognitive status within a given context. Their Givenness Hierachy as in Table (3) assumes that there are six major cognitive statuses that determine the occurrence of a particular expression. According to this hierarchy, zero and unstressed pronominals are preferentially used when the referent is represented in the language user's *focal attention* and all pronominal forms including demonstrative pronouns (e.g., *this*, *that*) and stressed personal pronouns should be used when the referent is *activated* in current short-term memory. Furthermore, a demonstrative determiner (*that N*) signals that the addressee is *familiar* with the referent, whereas definite noun phrases signal that the referent is *uniquely identifiable*.

The researchers assume that the use of each referring expression should meet all lower, but not higher statuses such that when using a pronoun, the referent must not only be in focus but also activated, familiar, uniquely identifiable, referential and type identifiable, whereas the use of a definite noun phrase does not require that the

referent is familiar, activated or in focus. Thus the set of possible referents is most restricted for pronominal reference, whereas it is least restricted for an indefinite reference.

Table 3. *Givenness hierarchy by Gundel, Hedberg, and Zacharski (1993, p.275)*

in focus	>	activated	>	familiar	>	uniquely identifiable	>	referential	>	type identifiable
it		*that* *this* *this* N		*that* N		*the* N		indefinite *this* N		*a* N

To test if the distribution of referring expressions supports the hierarchy, Gundel et al. (1993) conducted cross linguistic corpus analyses. They examined spoken and written corpora in five languages, collected from a variety of sources including novels, short stories and news broadcasts, and asked two trained coders to categorise the referent's cognitive status for the referring expressions that occurred in the transcripts. The results were largely consistent with what the hierarchy predicts. For instance, in English, almost all referents of the third-person pronoun *it* were judged as "in focus" (214 out of 215), and all referents of definite noun phrases (the N) were thought of as "uniquely identifiable". In Spanish, all Spanish zero pronouns had referents that were categorised as "in focus" and almost all referents of third person pronouns had referents identified as "activated".

It is obviously difficult to tap into the language user's mental state directly, so researchers normally provide definitions of indirect measures that they use to infer

the referent's cognitive status. In Gundel et al. (1993), these indirect measures that the coders had to use to categorise each referring expression are not clearly defined, except that a footnote says that syntactic structure and recency of mention were the main coding criteria but other criteria were also used. This causes us to question the validity of the near perfect match between the theory and the observations in their analyses, because we cannot rule out the possibility that the coders were biased. For instance, they might have categorised the referent's cognitive status based on the form of reference; the referent's cognitive status must be "in focus" because it is referred to by a pronoun rather than because of its properties in the discourse context. Therefore, there is no clear evidence that the cognitive statuses on the hierarchy indeed correspond to the language users' mental representation when they refer.

An important assumption that underlies these accessibility theories is that speakers choose referring expressions to signal the referent's cognitive status or accessibility to the addressee and thereby assist the addressee's identification of the referent. According to these linguists, the form of referring expression is, like word order and grammatical function assignment, one of the linguistic devices language users exploit to facilitate comprehension. For instance, Gundel et al. (1993) argued that "different determiners and pronominal forms conventionally signal different cognitive statuses (information about location in memory and attentional state), thereby enabling the addressee to restrict the set of possible referents" (p. 274). Such assumptions are shared with psycholinguists including Marslen-Wilson, Levy, and Tyler (1982), who argued that language production processes are adapted to the needs of language comprehension. They asked a participant to describe a narrative depicted in a comic book and analysed the distributional pattern of the referring expressions he produced. They found that lexically less specific referring

expressions such as pronouns and zero anaphors were used when the expressions were disambiguated by the linguistic context in which they occurred, and more explicit referring expressions such as names and definite noun phrases were used when the use of less explicit referring expressions did not identify the referent uniquely. Thus, they concluded that speakers choose referring expressions depending on whether contextual constraints favour a particular interpretation: "to the extent that the context for interpretation is more richly specified, then a less fully specified speech input can be tolerated" (p. 341). One important question is, though, whether speakers choose referring expressions in order to avoid ambiguity for their addressee or because speakers themselves experience referential ambiguity. This issue will be further explored in Chapter 2, which reviews research that investigated the role of addressee adaptation in the choice of referring expression.

Early psycholinguistic findings

While corpus analyses conducted by linguists have identified several global discourse factors, such as referential distance between the referring expression and the antecedent, as affecting the choice of referring expressions, early psycholinguistic research examined more fine-grained discourse properties, whose findings also informed accessibility theories.

Competition

Clancy (1980) may be one of the earliest who explained the choice of referring expressions as a function of referential competition. She had 20 English

and 20 Japanese speakers re-tell a short story depicted in a film to examine how they refer to human characters. She found that both in English and Japanese, as the number of intervening clauses between the antecedent and the anaphor increased, speakers produced more explicit forms of reference (nominal rather than pronominal references) more frequently, indicating that referential distance has an effect. Importantly, Clancy also found that the increase in explicitness was affected by the number of intervening referents mentioned between the anaphor and the antecedent; The more intervening entities were mentioned between the mentions of the antecedent and the anaphor, the more explicit referring expressions were produced, indicating that the number of referential competitors had an effect. Her findings led Givón (1983a) and Ariel (1990) to argue that referential distance as well as referential competition affects the referent's accessibility and the form of reference.

However, in Clancy (1980), referential distance and the number of intervening characters mentioned were correlated, because more characters were mentioned as the narrative proceeded, so it is not clear whether each factor has an independent effect. A written sentence completion experiment by Fletcher (1984) suggests that the mention of a referential competitor in the preceding sentence has an independent effect on the choice of referring expressions when the referential distance between the anaphor and the antecedent is held constant. Participants had to produce a new sentence by combining a context sentence (4a-c) and a target sentence (4d) by using a connective such as *and* and *but*. He examined how participants referred to the subject in the second clause (Pete in 4d) (i.e., *Pete intended to go bowling last night but Ø/he/Pete broke his leg*).

Contexts

4a. Pete intended to go bowling last night.

4b. Pete intended to go bowling with Sam last night.

4c. Sam intended to go bowling with Pete last night.

Target

4d. Pete broke his leg.

Fletcher argued that the target should be more prominent in Sentence (4a), where it was mentioned as the subject and no referential competitor was mentioned, than in (4b), where the target was the subject but a referential competitor (Sam) was mentioned as the prepositional object. In addition, the target should be more prominent in (4b) than in (4c), where a referential competitor (Sam) was the subject. Thus, according to accessibility theories (Ariel, 1990; Givón, 1983a, Gundel et al., 1993), less explicit referring expressions should be used most frequently following (4a) and they are more frequent following (4b) than (4c). Indeed, following (4a), participants almost never produced full noun phrases (including proper names) (less than 1%) while they frequently produced zero anaphors (53%) and pronouns (56%). In contrast, following (4b), the use of noun phrases was more common (27%) while the use of zero anaphors (27%) and pronouns (56%) were less common than in (4a). Furthermore, following (4c), participants further increased the frequency of noun phrases (77%) and reduced the use of pronouns (17%) and zero anaphors (less than 1%). Thus, the results suggested that the mention of a referential competitor and the antecedent's position in the preceding sentence influences the referent's accessibility and the choice of referring expressions.

In Fletcher (1984), because the referential competitor always had the same gender as the referent, the use of a pronoun was unambiguous following (4a), whereas it was ambiguous following (4b). Therefore, it is not clear whether the presence of a referential competitor decreased pronoun usage because it reduced the referent's accessibility or whether it affected the gender ambiguity of the pronoun. A more recent study by Arnold and Griffin (2007) addressed this issue by investigating if the prior mention of a different-gender competitor affects the use of pronouns and repeated names, which Chapter 3 will discuss in details.

Episodic boundary

The results of Anderson, Garrod, and Sanford (1983) suggested that referential distance is not only determined by textual distance – where the referent was mentioned last in the text – but it is also affected by *semantic distance* - whether the referent has been mentioned within the same or a different episode. The researchers assumed that discourse processing involves mapping of textual information onto semantic representations derived from prior discourse, so discourse representations do not only consist of information explicitly mentioned in the text but they also comprise the background semantic information (*scenarios*) that is inferred by language users. According to this scenario mapping model of discourse processing, an entity that is represented as part of the current episode is more accessible than the one that is represented in a past episode. For instance, Discourse (5) contains a central character, *Jenny*, watching a film, and a secondary character, "the projectionist", who is working in the cinema. Anderson et al. argued that the relevance of a secondary character is "scenario-dependent" in that when the episode

changes, its role in the story will also be diminished. For instance, the representation about the projectionist in (5) becomes less accessible when the adverbial in the final sentence (*Seven hours later*) exceeds normal cinema viewing time and hence indicates an episodic shift compared to when it does not (*Ten minutes later*). Indeed, when the researchers asked participants to write a sentence that follows the final sentence, participants were much less likely to mention the secondary character in the episode-shift condition than in the same-episode condition. Perhaps more importantly, they were much less likely to use a pronoun (relative to a noun phrase) to refer to the secondary character (projectionist) than the central character (Jenny) in the episode-shift condition while no such difference was found in the same-episode condition. The results thus supported the view that the referent's accessibility and the form of reference to it are not only affected by the textual distance, but also by the episodic distance.

5. At the cinema

   Jenny found the film rather boring.

   The projectionist had to keep changing the reels.

   It was supposed to be a silent classic.

   Ten minutes later
Seven hours later } the film was forgotten

Vonk, Hustinx, and Simons (1992), however, argued that the use of overly specific referring expressions at episodic boundaries does not result from the reduction in accessibility of the referent but because language users exploit variations in referential forms to signal a topic shift: Reduced referring expressions signal topic

continuity whereas explicit referring expressions signal a topic shift. In their experiment, participants were asked to produce a story based on strip cartoons, depicting a sequence of actions carried out by one human character, and the researchers examined if the choice of referring expression was related to the action continuity from the previous scene. When the target picture contained a shift in time and place, the protagonists were more likely to be referred to by names or definite descriptions (relative to pronouns), and participants were more likely to start their sentence by using a pre-posed adverbial phrase to signal a thematic shift (*The following day* or *After a good night sleep*) (Experiment 2), compared to when the target picture indicated a continuation from the previous scene. However, it is not clear from their results whether language users choose explicit referring expressions in order to signal a topic shift or whether, as Anderson et al. (1983) argued, they do so because the referent's representation becomes less accessible when there is a temporal shift in the narrative.

Centering theory: Local discourse coherence and reference form

When referring to the same entity repeatedly during the discourse, each reference must cohere with what has been said earlier. Centering (Grosz, Joshi, & Weinstein, 1995; Joshi & Weinstein, 1981; Walker, Joshi, & Prince, 1998) is perhaps one of the most influential computational theories of discourse coherence. The theory is concerned with how the structural properties of the local discourse context influence focus of attention, which they assume constrains the speaker's linguistic expressions and the addressee's interpretation of them. It has inspired psycholinguistic investigations of the preference of different referring expressions in

relation to the structural properties of the local discourse context during both comprehension and production.

Centering assumes that the language user's local attentional state consists of entities that are realised (or mentioned) in each utterance, which are ranked for salience as *forward looking centres*. The ranking of forward looking centres gets updated after every utterance, but coherence is maintained by what they call a *backward looking centre*, which provides a link to the previous utterance. The backward looking centre is defined as the entity that refers back to the most highly ranked forward looking centre in the preceding utterance (Grosz et al., 1995) and discourse is coherent if the backward looking centre in the preceding utterance is realised as the most prominent entity in the current utterance so that it *continues* to be the backward looking centre in the next utterance. In contrast, the discourse becomes less coherent if the backward looking centre in the preceding sentence is not realised as the most prominent entity in the current sentence; that is, although it *retains* the function of being the backward looking centre in the current utterance, it does not continue to be the backward looking centre in the next utterance. Even less coherent are cases where the backward looking centre in the preceding sentence is different from the one in the current sentence, such that each sentence talks about different things. Thus, Centering's concept of a backward looking centre is similar to the traditional notion of a discourse *topic*, in that both represent what the discourse is *about*. In accordance with some researchers who postulated that there is only one topic in each sentence (Reinhart, 1982), Centering also assumes that each sentence contains only one backward looking centre.

Use of pronoun for facilitating coherence

Another major claim of Centering theory concerns the use of pronouns. Grosz et al. (1995) argued that discourse coherence is determined by not only the identity of the backward looking centre, but also by the choice of referring expression that refers to it, because how an entity is referred to may influence the degree of inference required for the addressee and hence ultimately determine the coherence of the discourse. Centering therefore claims that in a coherent discourse, if any forward looking centre is pronominalised in an utterance, then the backward looking centre should also be pronominalised (Grosz et al., 1995; Walker et al., 1998). Given the Centering definition of a backward looking centre, this means that if any other entity in the current sentence is realised as a pronoun, the entity that refers to the most salient entity in the preceding sentence should also be pronominalised. The idea that the choice of referring expression is affected by the referent's salience in the prior discourse is in line with other reference theories such as Givón (1983a), Ariel (1990), and Gundel et al. (1993). But how does Centering define salience within their model?

Like other reference theories, Centering (Grosz et al., 1995; Joshi & Weinstein, 1991; Walker et al., 1998) assumes that the salience ranking of forward looking centres is affected by multiple factors. But the theory is fairly vague about what these factors are, which means that the backward sentence is not clearly defined in many utterances. Most versions of Centering, however, agree that the grammatical role of an entity is the major determinant for salience (Brennan, Friedman, & Pollard, 1987; Gordon, Grosz, & Gilliom, 1993; Grosz et al., 1995). For instance, Grosz et al. (1995) argued that Discourse (6) is more coherent than Discourse (7),

because in (6c), Susan continues to occupy the subject position, whereas in (7c), she is no longer mentioned as the subject, though she is the backward looking centre in that sentence. Furthermore, Discourses (8) and (9) are less coherent compared to Discourses (6) and (7) respectively. In (8c) and (9c), Susan is the backward-looking centre. Given that Betsy, who is not the backward-looking centre, is realised by a pronoun, Susan should also be referred to by a pronoun.

6a. Susan gave Betsy a pet hamster.

6b. She reminded her that such hamsters were quite shy.

6c. She asked Betsy whether she liked the gift

7a. Susan gave Betsy a pet hamster.

7b. She reminded her that such hamsters were quite shy.

7c. Betsy told her that she really liked the gift.

8a. Susan gave Betsy a pet hamster.

8b. She reminded her that such hamsters were quite shy.

8c. Susan asked her whether she liked the gift.

9a. Susan gave Betsy a pet hamster.

9b. She reminded her that such hamsters were quite shy.

9c. She told Susan that she really liked the gift.

Notice that Grosz et al.'s (1995) Centering does not provide a straightforward prediction for the use of pronouns. The theory only claims that if any entity is to be

pronominalised in a sentence, the backward looking centre must also be pronominalised, so it does not make any claim about pronoun use when no other entity is promoninalised in that sentence. For instance, in (6c), where Betsy, who is not the backward looking centre by the Centering definition, is referred with a name, the theory does not predict whether a pronoun or a name is preferred for Susan, the backward looking centre in that sentence. It was Gordon et al. (1993) who made the stronger claim that the backward looking centre should be pronominalised even when no other entity is pronominalised. Although the evidence that this claim is based upon comes from comprehension, research by Gordon and his colleagues has theoretical implications for production preferences, given that Centering theory was formulated to predict not only comprehension preferences but also production preferences. Thus, below I will discuss some of the seminal comprehension work conducted by Gordon and his colleagues.

Using a self-paced reading paradigm, Gordon et al. (1993) compared reading times for discourse sequences such as (10-12) (Experiment 1).

10a. Bruno was the bully of the neighborhood.
10b. Bruno chased Tommy all the way home from school one day.
10c. Bruno watched Tommy hide behind a big tree and start to cry.
10d. Bruno yelled at Tommy so loudly that all the neighbors came outside.

11a. Bruno was the bully of the neighborhood.
11b. He chased Tommy all the way home from school one day.
11c. He watched him hide behind a big tree and start to cry.
11d. He yelled at him so loudly that all the neighbors came outside.

12a. Bruno was the bully of the neighborhood.

12b. He chased Tommy all the way home from school one day.

12c. He watched Tommy hide behind a big tree and start to cry.

12d. He yelled at Tommy so loudly that all the neighbors came outside.

In all Discourses (10-12), after having been introduced in the first sentence, Bruno keeps occurring in the subject position and continues to be the backward looking centre for the rest of the sequences. In Discourse (10), however, a repeated name is used to refer to Bruno, whereas in Discourses (11) and (12), a pronoun is used to refer to him after the first sentence. Gordon et al. found slower reading times when Bruno was realised as a repeated name (10b-d) rather than a pronoun (11b-d & 12b-d) (an effect termed the *repeated name penalty*), suggesting that a pronoun was easier than a repeated name. But crucially, no reading time difference was found between Discourse (11c-d), where a pronoun was also used to refer to the object position (Tommy), and Discourse (12c-d), where a repeated name was used to refer to that character, suggesting that the repeated name penalty did not occur with the object character and the effect was not due to a general advantage of a pronoun over a repeated name. Furthermore, slower reading times in (10b-d) than (12b-d) indicated that the repeated name penalty was not limited to conditions where the other character was realised by a pronoun, because in (12), Tommy was referred to by a name. Thus, the results suggested that a pronoun is preferred over a repeated name to refer to the backward looking centre, whether or not the other entity is realised by a pronoun.

In line with other researchers who work in the Centering framework (e.g., Brennan et al., 1987; Grosz et al, 1995), Gordon's version of Centering theory

assumes that the salience ranking of the forward looking centres is affected by their structural position in the sentence. Gordon and Chang (1995, Experiment 2) found that following (13a), Sentence (14) was read faster when a pronoun (*She*) rather than a repeated name (*Susan*) was used. Importantly, the effect of the repeated name penalty was larger than when Sentence (14) followed (13b), where the antecedent was not mentioned in the subject position. This suggested that the repeated name penalty is affected by the structural position of the antecedent. The researchers further demonstrated that the repeated name penalty was not modulated by whether the anaphor occurring as the first-mentioned subject was the agent of an active sentence (e.g., *She/Susan told him exactly what to feed it.*) or a patient of a passive sentence (e.g., *She/Susan was questioned by him about what to feed it.*), indicating that the repeated name penalty is not affected by the semantic role of the backward looking centre (Experiment 1).

Context

13a. Susan decided to give Fred a hamster.

13b. Fred agreed to take care of Susan's hamsters for the weekend.

Target

14. She/Susan told him exactly what to feed it.

The idea that the grammatical role of the antecedent affects the use of pronouns is shared by Brennan (1995) who investigated the preference of pronouns over repeated noun phrases in production. In her experiment, participants described a videotaped basket ball game to their addressees. When referring to a player who had not played a prominent role in the game, speakers tended to assign the grammatical object rather

than the grammatical subject role and frequently used a full noun phrase to refer to that character. When the character in the grammatical object position was re-mentioned, a repeated noun phrase instead of a pronoun was typically used, whereas the use of a pronoun was more frequent when the referent was realised as the grammatical subject in the preceding sentence. Thus, Brennan argued that when referring to a less prominent entity, speakers increase its prominence by giving it the subject role and using a full noun phrase. A pronoun is used only after the referent has been made salient by the preceding sentence.

Grammatical role versus first-mention advantage

In Gordon and Chang (1995), the fact that the repeated name penalty was found following Sentence (13a), but not following Sentence (13b) may not necessarily have been due to the difference in the grammatical role of the antecedent. In (13a), *Susan* is the first-mentioned character, whereas in (13b) she is the second-mentioned character. That is, the repeated name penalty may occur for the first-mentioned antecedent, but not for the second-mentioned antecedent, because the first-mentioned antecedent may be more accessible than the second-mentioned character (Gernsbacher & Hargreaves, 1988; Gernsbacher, Hargreaves, & Beeman, 1989). Indeed, in Gordon et al. (1993, Experiment 5), both the grammatical role and the surface sentence position appeared to influence the salience ranking of discourse entities and affect the repeated name penalty. Pronouns were read faster than names for subject antecedents that did not occur in sentence initial position as well as for prepositional object antecedents that occurred in sentence initial position. The pronoun advantage was found in (17a), where the referent was mentioned as the

second mentioned subject (*she*) in the preceding sentence (16), and in (17b), where the referent was mentioned as the first-mentioned prepositional object (Fred) in the preceding sentence (16).

Context

15. Susan gave Fred a pet hamster.

16. In his opinion, she shouldn't have done that.

Target

17a. She/Susan just assumed that anyone would love a hamster.

17b. He/Fred doesn't have anywhere to put a hamster cage.

However, it is not entirely clear whether the effects were obtained because the grammatical role and the sentence position indeed affected the salience ranking. In the preceding sentence (16), the referent was mentioned by a pronoun (rather than a name as in other experiments), so the slower reading time for a pronoun over a repeated name for reference to Susan in (17a) and Fred in (17b) may be due to the change from a pronoun to a name. Perhaps the use of a more explicit referring expression signalled a topic shift (cf. Vonk et al., 1992), slowing down the integration of the two sentences. Therefore, the repeated name penalty may not occur with second-mentioned subject antecedents or first-mentioned non-subject antecedents realised as names.

Interestingly, Gordon et al. (1993) argued that the surface sentence position of the anaphor (or the backward looking centre) has no effect on the repeated name penalty. No repeated name penalty was found with anaphors in the prepositional

object position, whether or not they were the first-mentioned character (Elizabeth in 19) or not (Tom in 19) (Experiment 2).

Context

18. Elizabeth read Tom's palm the other day.

Target

19. According to her/Elizabeth, good things were in store for him/Tom.

Context

20. Susan gave Fred a pet hamster.

Target

21. In his/Fred's opinion, she/Susan shouldn't have done that.

In contrast, a repeated name penalty was found (Experiment 3) with non-sentence initial subject anaphors, with slower reading times for *Susan* than *she* in (21) following (20), suggesting that the repeated name penalty is affected by the grammatical role of the anaphor, not by its position in the sentence. Gordon et al. therefore argued that the grammatical subject has a special role in establishing a coherent link between utterances. This idea is consistent with linguistic accounts that regard grammatical subjects as the discourse topic (Chafe, 1976) and the conveyer of given information in the discourse (Prince, 1981).

However, Gordon and Chang (1995, Experiment 4) found that a repeated name penalty could occur with object anaphors when the subject in the anaphor sentence conveys new information. Following a context sentence (22), slower reading times were found not only when the subject in (23a) was a repeated name

(*John*) rather than a pronoun (*He*) but also when the direct object in (23b) was realised by a repeated name (*John*) rather than a repeated name (*him*). The researchers argued that in (23b), the grammatical subject conveys discourse-new information (Patricia) and hence could not be the backward looking centre. In that case, another entity in a strong grammatical role is preferentially interpreted as the backward looking centre, affecting a preference for pronoun over repeated name.

Context

22. John was at the mall yesterday.

Target

23a. He/John was seen by Patricia there.

23b. Patricia saw him/John there.

Structural parallelism

According to Gordon and his colleagues, therefore, the repeated name penalty is primarily determined by the grammatical role or sentence position of the antecedent and the grammatical role of the anaphor. There is an alternative hypothesis, however. Researchers have argued that the structural relationship between the antecedent and the anaphor affects anaphoric processing. For instance, ambiguous pronouns preferentially refer to the antecedent that has the same grammatical role (e.g., Grober, Beardsley, & Caramazza, 1978; Sheldon, 1974): The antecedent of *he* in Sentence (24a) is preferentially interpreted as referring to the subject in the first clause (William), whereas *him* in Sentence (24b) tends to be interpreted as co-referential with the object in the first clause (Oliver), if the pronoun is unstressed. This claim

was experimentally supported by work including Smyth (1994), who used an off-line rating measure, and Stevenson, Nelson, and Stenning (1995) who used a self-paced reading paradigm.

24a. William hit Oliver and he slapped Rod.

24b. William hit Oliver and Rod slapped him.

Whether structural parallelism affects the repeated name penalty was tested by Chambers and Smyth (1998). In their self-paced reading experiment, participants read target sentences (27a-d), in which the anaphors (a pronoun or a repeated name) referred back to antecedents in the immediately preceding sentence (26). Crucially, the antecedent and the anaphor were realised in either parallel (27a-b) or non-parallel positions (27c-d) (Experiment 2). Target sentences were read faster when the anaphor was a pronoun rather than a repeated name *only* when the anaphor was mentioned in a parallel position to the antecedent. Such findings were not predicted by Gordon et al. (1993), who argued that the repeated name penalty occurs when the grammatical subject or the first-mentioned entity in the preceding sentence is referred to by a repeated name rather than a pronoun, which is realised as the subject. Therefore, the repeated name penalty should have been found only when the antecedent was the grammatical subject as in (27a) and (27d), not when it was the grammatical object as in (27b) and (27c). Thus, Chambers and Smyth argued that the ease of pronouns relative to repeated names is determined by the parallel positions of the antecedent and the anaphor.

Context

25. A group of celebrities were having car trouble.

26. Martin Miles told Liz Lovejoy to check the oil.

Target

27a. Then he/Martin Miles told Dean Morgan to inspect the coolant. *Parallel*

27b. Then Dean Morgan told her/Liz Lovejoy to inspect the coolant. *Parallel*

27c. Then she/Liz Lovejoy told Dean Morgan to inspect the coolant. *Nonparallel*

27d. Then Dean Morgan told him/Martin Miles to inspect the coolant. *Nonparallel*

Furthermore, Chambers and Smyth (1998) showed (Experiment 3) that the repeated name penalty could occur for more than one entity simultaneously (contra Gordon's claim that there should be only one backward looking centre). Following context sentences (28-29), participants read target sentences (30a-d), where the referring expressions for the two characters introduced in the preceding sentence (e.g., Debbie and David) were orthogonally manipulated. Reading times of the target sentences were faster when both characters were referred to by a pronoun (30d), compared to when only one of them was referred to by a pronoun (30b-c) or when both were mentioned by a name (30a). The results were inconsistent with Gordon et al. (1993), who found a repeated name penalty for the subject anaphor, but not for the non-subject anaphor (Experiment 1) as well as Gordon and Chan (1995), who argued that a repeated name penalty for the non-subject anaphor should be found only when the subject in the anaphor sentence conveys new information: in Chambers and Smyth, the subject in the anaphor sentence (Debbie) was not discourse new.

Context

28. A fight was in full swing in the back yard.

29. Debbie punched David in the nose.

Target

30a. Then Debbie slugged David in the ribs. *Name–Name*

30b. Then she slugged David in the ribs. *Pronoun–Name*

30c. Then Debbie slugged him in the ribs. *Name–Pronoun*

30d. Then she slugged him in the ribs. *Pronoun–Pronoun*

Thus, Chambers and Smyth concluded that the form of anaphoric expressions signals whether the anaphor refers to an antecedent in a parallel position or not: Pronouns preferentially refer to an antecedent in a parallel position, whereas repeated names refer to an antecedent in a non-parallel position. But what is the nature of such parallelism effect? One possibility is that following the connective *Then*, participants may have interpreted the target sentence as a description of an action sequence continuing from the preceding context sentence, such that at least one of the characters mentioned in the context sentence would continue to participate in the action. Because both the context and the target sentences were always active and the verbs used in the two sentences had identical or very similar meanings, the parallel position of the anaphor facilitated action continuity by indicating that the referent continues to play the same semantic role as in the antecedent sentence. A pronoun was read faster than a repeated name in the parallel condition, perhaps because pronouns signal a continuation of the previous episode, whereas names signal a shift from the previous episode (Anderson et al., 1983; Vonk, 1992); that is, pronouns were more consistent with the semantic interpretation induced by the parallelism,

whereas repeated names were not. In contrast, when the target sentence did not mention any of the characters in a parallel position, there was no character that could connect the two separate sentences to depict a single action sequence, resulting in no advantage for pronouns over repeated names.

Almor's (1999) information load hypothesis

Almor (1999) argued that the repeated name penalty does not merely result from the violation of the Centering constraint on pronoun use as claimed by Gordon et al. (1993), but it is determined by a general constraint of meeting the cost and function of anaphoric expressions. He claims that the ease of anaphoric processing is determined by the interaction between the salience of the antecedent in the discourse representation and the degree of semantic overlap between the antecedent and the anaphor (in his terms, the *informational load*). Almor assumes that when the antecedent is highly salient, its semantic representation is highly activated in working memory. Under such conditions, repeated noun phrases are harder to process than reduced referring expressions such as pronouns because the high semantic overlap between the anaphor and the antecedent places a high demand on working memory capacity, just as high phonological overlap reduces working memory capacity more for phonological processing (Baddeley, 1992). When the antecedent is less salient, its semantic representation is less activated, so repeated noun phrases do not pose a high demand on working memory capacity, and they can instead facilitate comprehension, because the anaphor that has a more overlapping semantic representation with the antecedent can reactivate the antecedent's semantic representation more effectively.

According to Almor (1999), however, there is another constraint that affects the processing of anaphoric expressions. He argues that while the increase in salience adversely affects the processing of repeated noun phrases, non-repeated anaphors that are more informative than their antecedents are not affected by it because they add new information about the referent. For instance, the noun phrase anaphor *the robin* is more specific about the identity of the referent than the antecedent *a bird* and therefore provides additional information about the referent's identity. The use of such non-repeated anaphors does not result in processing difficulty when the antecedent is highly salient, because their high informational load has the functional justification of providing new information. In contrast, the use of a repeated noun phrase for a highly salient antecedent affects processing difficulty, because it neither adds any new information nor helps identifying the referent.

Indeed, in a series of self-paced reading experiments, Almor (1999) found that the antecedent's salience affected the ease of noun phrase anaphors differently depending on whether the anaphor provided new information about the referent. Following one of the context sentences in (31), participants read one of the target sentences in (32). Noun phrase anaphors such as *the bird* in (32a) and *the fruit* in (32b) were read faster when the antecedents were made salient by syntactic clefting (*the robin* in 31a & *the apple* in 31b respectively) than when the non-antecedents were clefted (*the robin* in 31b & *the apple* in 31a), indicating that the antecedent's salience facilitated anaphoric processing. Crucially, antecedent salience also facilitated the processing of anaphors that were *more* informative about the referent than their antecedents: Highly informative anaphors such as *the robin* (34a) and *the apple* (34b) were read faster when the antecedents were made more salient by the preceding sentence as *the bird* in (33a) and *the fruit* in (33b) respectively compared

to when they were not as *the bird* in (33b) and *the fruit* in (33a). In contrast, antecedent salience adversely affected the processing of repeated noun phrases: *The bird* in (32a) and *the fruit* in (32b) were read *slower* when they were preceded by a sentence that clefted the antecedents as in (33a) and (33b) than otherwise as in (33b) and (33a), indicating that the high semantic similarity between the anaphor and the antecedent resulted in a greater processing cost when the referent is salient in the discourse.

Context

31a. It was the robin that ate the apple.

31b. What the robin ate was the apple.

Target

32a. The bird seemed very satisfied.

32b. The fruit was already half rotten.

Context

33a. It was the bird that ate the fruit.

33b. What the bird ate was the fruit.

Target

34a. The robin seemed very satisfied.

34b. The apple was already half rotten.

Furthermore, Almor (1999) found (Experiment 5) that when the antecedent was salient and the anaphor did *not* add new information, the more semantically similar the anaphor to the antecedent, the harder it was to process. When the antecedent was

highly salient in the discourse (because it was clefted), noun phrase category anaphors such as *the vehicle* were read faster when the antecedent was an atypical (e.g., *the boat*) rather than typical (e.g., *the car*) exemplar from the semantic category, suggesting that for a highly salient antecedent, the less semantically overlapping the anaphor relative to the antecedent (*the vehicle-the boat* rather than *the vehicle-the car*), the easier it was. In contrast, when the antecedent was less salient in the discourse, anaphors with atypical antecedents were read slower than those with typical antecedents, though this effect was marginal. The advantage of atypical antecedent-anaphor pairs is inconsistent with Garrod and Sanford (1977), who found that atypical antecedent-anaphor pairs (*A tank – the vehicle*) led to slower reading times of the anaphor sentence relative to typical antecedent-anaphor pairs (*A bus – the vehicle*). One possible reason for this discrepancy is that Almor (1999) compared the reading times of anaphoric subjects, whereas Garrod and Sanford (1977) compared those of the entire sentences containing the anaphor. It might be that anaphor sentences with atypical antecedents are harder to integrate into the discourse representation, whereas the processing of anaphors with atypical antecedents may be easier than the processing of anaphors with typical antecedents (but see also Van Gompel, Liversedge, & Pearson, 2004).

What is not very clear about Almor's theory (1999) is why and how the functionality of a highly informative anaphor could offset its high processing load. If working memory demand is affected by the degree of semantic overlap between the antecedent and the anaphor, we would expect that if the antecedent is highly salient, a highly informative anaphor should pose a high processing demand, whether it provides additional information about the referent (e.g., when the anaphor is *the robin* and the antecedent *the bird*) or not. An alternative explanation is that repeated

anaphors behave differently from other noun phrase anaphors in that working memory demand is affected by the phonological overlap between the antecedent and the anaphor: When the antecedent is more salient, its phonological representation is more salient in working memory, so the repetition of the phonological representation poses a higher processing demand on working memory than the use of non-repeated noun phrase anaphors.

The idea that working memory capacity affects preferences for different referential forms is supported by Almor, Kempler, MacDonald, Andersen, and Tyler (1999), who examined anaphoric processing by Alzheimer patients both in production and comprehension. Participants were asked to provide autobiographical details such as place of birth and family history and researchers analysed the type of nominal reference produced by Alzheimer patients and control participants (Experiment 1). Although the two groups did not differ in terms of the number of nominal references or number of words they produced, Alzheimer patients were more likely to use pronouns than healthy controls. The increased pronoun usage by the patients was found to be correlated with working memory impairment (measured by a "month ordering task", where participants had to recall a given set of months by putting them in the correct calendar order), but it was related neither with semantic impairment (measured by a word comprehension task and a picture naming task) nor the severity of dementia itself.

In contrast, during comprehension, Alzheimer patients showed more difficulties in processing pronouns than full noun phrases (Experiment 3). After the auditory presentation of discourses (35a) and (35b), patients had to name an adjective which was presented as a visual target. The adjective was explicitly mentioned as modifying one of the characters (e.g., clumsy) in the discourse

sentences, and the researchers measured the naming latencies as an indicator of the level of activation of the modified referent in memory. In the pronoun condition (35a), the characters (housewife, plumber) were referred to by pronouns following their initial introduction, whereas in the full noun phrase condition (35b), they were mentioned by repeated noun phrases.

35a. The housewife watched the clumsy plumber working under the sink. She showed him where the leak was. She could not believe that he was so _____."

35b. The housewife watched the clumsy plumber working under the sink. The housewife showed the plumber where the leak was. The housewife could not believe that the plumber was so _____."

While healthy controls named the target adjective faster in the pronoun condition than in the full noun phrase condition, Alzheimer patients named the adjectives faster in the full noun phrase condition than in the pronoun condition. Furthermore, the advantage of nominal over pronominal reference for Alzheimer patients was shown to be correlated with their working memory score: The lower the working memory score, the slower naming in the pronoun relative to full noun phrase conditions.

Almor et al. (1999) argued that Alzheimer patients tend to overuse semantically impoverished referring expressions like pronouns and have difficulties in comprehending pronouns that provide little information about the referent, because Alzheimer patients cannot actively maintain discourse representations in

working memory due to their working memory deficits, and as a result, the referent's semantic representation deteriorates much more rapidly compared to healthy controls. The claim that the referent's representation in working memory is critical for the preference of pronouns over more explicit expressions is shared with other discourse researchers. For instance, Sanford and Garrod (1981) suggested that the representation of a discourse topic is given a "special status" in working memory and will not fade while other representations come and go without being maintained in working memory. In Purkiss (1978, as cited in Sanford & Garrod, 1981), a pronoun was read faster than a repeated noun phrase when referring back to an entity in the immediately preceding sentence, both when the antecedent was the subject and when it was the object. However, as the number of intervening words increased, the advantage of a pronoun over a repeated noun phrase diminished when the antecedent was the object, whereas the effect remained unaffected for the subject antecedent. Sanford and Garrod (1981) therefore argued that pronominal reference is easier for the subject antecedent than the object antecedent, because entities in the subject position are maintained in working memory for future reference, whereas those in the object position are not. Furthermore, Gundel et al. (1993) assumes special attentional status for the referent of pronominal references. They claim that the most reduced referring expressions such as zero and unstressed pronouns are used when "the referent is not only in short-term memory, but is also at the current centre of attention" (p. 279) and stressed pronouns and demonstrative pronouns are used when "the referent is represented in current short-term memory" (p. 278). The notion of attentional focus is also prevalent in Grosz et al.'s (1993) Centering theory, which was developed to account for "immediate focusing", or the local discourse processes

in which a set of discourse entities are brought into the centre of attention of language users.

Active versus passive representation

Indeed, many researchers have suggested that the accessibility of a representation depends on how it is stored in memory. Some have argued that representations that are concurrently processed in the current focus of attention are more accessible than those that are not currently attended and hence require retrieval from memory (McElree, 1996; 1998; McElree & Dosher, 1989; 1993; Wickelgren, Corbett, & Dosher, 1980). Similarly, representations that are within the working memory span are more accessible than those stored outside the working memory span (Baddeley, 1986; Baddeley & Hitch, 1974; Schneider & Detweiler, 1988; Shallice & Vallar, 1990). The question is whether prominent discourse entities are stored in different memory states than non-prominent entities.

A recent study by Foraker and McElree (2007) suggested that they do not. Using a speed-accuracy trade off (SAT) method, the researchers investigated whether language users actively maintain prominent discourse entities in their current focus of attention, as suggested by Gundel et al. (1993). In an SAT experiment, participants are asked to respond at different response deadlines, allowing researchers to separate processing speed and response accuracy. Research using SAT methods (McElree, 1996; 1998; McElree & Dosher, 1989; 1993; Wickelgren et al., 1980) has found that participants tend to recognise items much more quickly when there is no intervening activity between study and time of testing compared when there is, if response accuracy is taken into account. Therefore, these SAT researchers assume that participants respond more quickly to information that is

within the current focus of attention and hence "immediately on hand" for further processing, compared to other information that is not currently attended and has to be recovered from passive memory (see McElree, 2006, for review).

In Foraker and McElree (2007), participants read context sentences, in which syntactic clefting made either the first mentioned noun phrase (NP1) (*the ardent boyfriend* in 36a) (it-cleft) or the second-mentioned noun phrase (NP2) (*the engagement ring* in 36b) (what-cleft) salient, and then they were presented with a target sentence that contained a pronoun that referred to NP1 or NP2. Participants were asked to judge, as quickly as possible, if the target sentence was a sensible continuation from the context sentence, and the researchers examined how well they discriminated acceptable (37a & 37c) from unacceptable (37c & 37d) continuations.

Context

36a. It was/**the ardent boyfriend**/who contemplated/the engagement ring.

36b. What/the ardent boyfriend/contemplated was/**the engagement ring**.

Target

37a. *He stared.*

37b. *# He sparkled.*

37c. It sparkled.

37d. # It stared.

The idea is that if salient information is maintained in focal attention, access to that information should be faster than to information that is not salient (McElree, 1996; 1998). As a result, whether a pronoun refers to a clefted or non-clefted antecedent should affect the speed (rather than accuracy) of acceptability judgements in a SAT task: the speed parameter of the SAT function should be higher for clefted than non-

clefted antecedents. Alternatively, people may not maintain any discourse representation in focal attention but store them in a passive memory such that both clefted and non-clefted antecedents require the same retrieval processes for further processing. But syntactic clefting may influence the referent's *strength* or *quality of representation* in memory. That is, the more prominent the referent is in the discourse, the more saliently or clearly represented it is, so clefted antecedents may be represented more saliently than non-prominent antecedents. This predicts that clefting should not affect the speed but accuracy in an SAT task: Participants should be *more accurate* when the pronoun refers to a clefted rather than non-clefted antecedent, because the clefted antecedent should be more clearly represented in memory and hence more accurately identified.

Participants were more accurate in discriminating acceptable (37a & 37c) from unacceptable (37c & 37d) continuations when the antecedent referred back to the clefted antecedents (NP1 in 26a & NP2 in 26b) rather than non-clefted antecedents (NP2 in 26a & NP1 in 26b), but the time-course did not differ depending on whether the antecedent was clefted or non-clefted, suggesting that syntactic clefting made the antecedent representation more salient for later retrieval but did not bring the clefted antecedent into focal attention. Interestingly, the sentences with gendered pronouns (*he* or *she*) were responded to both more accurately and had a faster time-course than those with non-gendered pronouns (*it*), indicating that gendered animate antecedents might be represented in focal attention while non-gendered inanimate antecedents were not. However, in a subsequent eye-tracking experiment (Experiment 2), where they examined participants' reading behaviour, an advantage of gender marked pronouns was found only in later measures. Foraker and McElree argued that animate antecedents were responded more quickly in

Experiment 1, not because they were actively maintained in focal attention, but because gender marked pronouns provide additional information about the referent's identity compared to non-gender marked pronouns.

The results from Experiment 1 were replicated in Experiment 3, where the researchers contrasted pseudo-cleft structures (*The one whom the lead paint annoyed was the safety inspector)* with it-cleft structures (*It was the lead paint that annoyed the safety inspector*), which allowed an inanimate noun phrase to be NP1 and an animate noun phrase to be NP2 (unlike in Experiments 1 and 2). Again, the time-course measures for gender marked pronouns were faster than non-gender marked pronouns even when they were NP2, suggesting that the time-course advantage of gender marked pronouns found in Experiment 1 was not due to the privileged status of NP1 over NP2 in the current focus of attention, but rather because gender marked pronouns were less ambiguous than gender unmarked pronouns, providing a better cue for retrieval. Furthermore, participants were more accurate but no faster in resolving pronouns referring to clefted antecedents than non-clefted antecedents, consistent with Experiment 1. Thus the researchers concluded that language users do not actively maintain the entities made prominent by syntactic clefting in focal attention. Instead, all discourse entities are represented in the same memory storage, but clefted antecedents are represented more clearly and are less susceptible to memory decay compared to non-clefted entities.

Foraker and McElree's (2007) conclusion that language users do not actively maintain discourse representations in focal attention makes sense given the fact that during discourse, language users have to process many different kinds of information for decoding incoming linguistic material and encoding their message into linguistic representations. It is not so surprising that language users allocate their attentional

resources to these other processes, instead of maintaining already-processed information. Another point that seems worth noting is Foraker and McElree's conclusion that the faster and more accurate responses in animate than inanimate conditions results from the availability of gender marking on pronouns, not because of the higher salience of animate over inanimate antecedents in memory. This conclusion contradicts those of many researchers who have assumed that animate entities are more salient or more accessible than inanimates (e.g., Bock, Loebell, & Morey, 1992; Bock & Warren, 1985; Givón, 1983a; Prat-Sala & Branigan, 2000). The problem is that in Foraker and McElree, the animate and inanimate conditions were different not only in terms of the animacy of the antecedent, but also in terms of whether the pronoun provides additional information about the identity of the referent (*he* or *she* indicates the gender of the referent, whereas *it* does not), so whether the advantage of animate over inanimate antecedents was due to the different pronouns used for animates or inanimates or the higher salience of animates over inanimates in memory could not be established. To determine the nature of the animate advantage effect, it would be useful to test materials where both animate and inanimate entities are plural, because they would then be referred to with the same pronoun (*they*). Alternatively, testing other Indo-European languages, where inanimate entities have grammatical gender and hence pronominal reference to inanimate entities could also be disambiguated by gender marking on pronouns, would also be useful.

Implicit causality and semantic roles

So far, I have discussed studies that investigated structural aspects of the discourse as a determinant of the preference for particular expressions. Past research has also investigated if the semantics of the preceding discourse affects the choice of referring expressions. Many studies have shown that following *because* in the context of (38a), people are more likely to continue the clause by referring to *John (e.g., because he/John was clever)*, whereas following the context of (38b), they are more likely to refer to *Peter* (e.g., *because he/Peter was easily impressed*) (e.g., Au, 1986; R. Brown & Fish, 1983; Caramazza, Grober, Garvey, & Yates, 1977; Garvey, Caramazza, & Yates, 1975; Stevenson et al., 1994).

38a. John impressed Peter, because . . .

38b. John admired Peter, because . . .

Such completion preferences have been argued to arise because the meaning of the verb implicitly biases how people assign the cause of the event (*implicit causality bias*). Verbs such as impress have a causality bias towards the first mentioned subject (NP1), whereas verbs such as admire have a bias towards the second mentioned object (NP2), because the semantic roles associated with the meaning of the verb are more likely to be considered as the cause of the event than other roles (Au, 1986; R. Brown & Fish, 1983; Crinean & Garnham, 2006; Stevenson et al., 1994). For instance, in (38a), John plays a stimulus role and Peter an experiencer role, whereas in (38b), the semantic roles are reversed. The reason why John is the preferred referent in (38a), whereas Peter is the preferred referent in (38b) is that

people are more likely to associate the stimulus with the cause of the event than the experiencer.

The crucial question is whether such completion preferences affect the preference for pronouns over names. Researchers who work on anaphoric processing have assumed that implicit causality biases influence the accessibility of discourse entities such that the bias-consistent entity is more accessible than the bias-inconsistent entity (often termed the *semantic focusing account*). Indeed, research has shown that people tend to interpret ambiguous pronouns as co-referential with bias-consistent rather than bias-inconsistent entities (e.g., Garvey & Caramazza, 1974; Garvey et al., 1975; Kehler, Kertz, Rohde, & Elman, 2008; Stevenson et al., 1994), and unambiguous pronouns are comprehended faster when the antecedent is bias-consistent rather than when it is not (Koornneef & Van Berkum, 2006; Van Berkum, Koornneef, Otten, & Neuwland, 2007; Vonk, 1985). Furthermore, probe recognition studies have shown that names are recognised more quickly when they denote bias-consistent entities than otherwise (Long & De Ley, 2000; McKoon, Greene, & Ratcliff, 1993).

The semantic focusing account accords well with functional linguists (Givón, 1983a, 1988; Kuno, 1972) who argued that the more predictable an entity, the more accessible it is, and is consistent with Centering theory, which presupposes that the relative prominence of discourse entities should correspond to the likelihood with which an entity is mentioned again (Brennan et al., 1987; Grosz et al., 1993). If likelihood of reference indeed affects the referent's accessibility, more pronouns (relative to more explicit referring expressions) should be used for bias-consistent entities than bias-inconsistent entities. Such an account has been put forward by Arnold (2001; 2008), who argued that the semantic role that is most likely to be

referred to next should be referred to by reduced referring expressions such as pronouns rather than more explicit alternatives. In fact, according to Arnold's *expectancy account*, all the factors that have been shown to influence the likelihood of reference should have an effect on the choice of referring expression. For instance, recency of mention should have an effect on the choice of anaphor (Ariel, 1990; Givón, 1983a) because the more recently the referent has been mentioned, the more likely it is to be mentioned again, so less explicit referring expressions are used to refer to the more recently mentioned entities. Similarly, the antecedent's grammatical role should have an effect because the higher the grammatical role, the more likely it is to be referred to.

Arnold (2001) contrasted references to the goal versus the source role when participants had to complete auditorily presented stories such as (39). In (39a), Marguerite (the subject) is the goal, whereas Eduardo (the oblique object) is the source. In contrast, in (39b), the positions of the semantic roles are reversed: Brendan (the oblique object) is the goal and Lisa (the subject) the source.

39a. I hate getting sick. It always seems like everyone gets sick as soon as it's vacation. Marguerite caught a cold from Eduardo two days before Christmas.

39b. There was so much food for Thanksgiving, we didn't even eat half of it. Everyone got to take some food home. Lisa gave the leftover pie to Brendan. ...

She found that participants referred to the goal (Marguerite in 39a, Brendan in 39b) more frequently than the source (Eduardo in 39a, Lisa in 39b) as the subject in their completions. Importantly, pronouns (relative to repeated names) were more

frequently used to refer to the goal than the source in the preceding sentence, indicating that the more likely the entity was referred to, the more reduced referring expressions were used. In addition, she also found that pronouns were preferred over repeated names for the subject (Marguerite in 39a, Lisa in 39b), whereas repeated names were more common for the oblique object (Eduardo in 39a, Brendan in 39b), in line with other studies that showed that the antecedent's structural properties determine the choice of referring expressions (Crawley & Stevenson, 1990; Fletcher, 1984; Stevenson, 2002; Stevenson et al., 1994).

However, Stevenson et al. (1994) suggested that likelihood of reference may not influence the form of reference. They investigated how semantic roles of discourse participants influence the interpretation of an ambiguous pronoun as well as which entity is mentioned next when there is no pronoun. Using a written sentence completion task, they contrasted different semantic roles such as *goal* versus *source*, *agent* versus *patient* and *stimulus* versus *experiencer*, when the roles occurred either in NP1 or in NP2 in the first sentence. Participants were asked to produce a second clause or sentence that either ended with a pronoun as the subject or did not contain any subject (so participants were free to produce whatever continuations they preferred) (40-42). Below shows sentences used in Experiment 1.

Goal-Source

40a. John seized the book from Bill. He/……..

40b. John passed the comic to Bill. He/ ……

Agent-Patient

41a. Joseph hit Patrick. He/ …

41a. Patrick was hit by Joseph. He/ ……

Stimulus-Experiencer

42a. Ken impressed Geoff. He/ ……

42b. Ken admired Geoff. He/ ……

Stevenson et al. (1994) found that in both the pronoun and no-pronoun conditions, semantic roles influenced continuations similarly: Participants preferred the goal (John in 40a, Bill in 40b) over the source (Bill in 40a, John in 40b), the patient (Patrick in 41a & 41b) over the agent (Josephe in 41a & 41b), and the stimulus (Ken in 42a & Geoff in 42b) over the experiencer (Geoff in 42a & Ken in 42b) as the antecedent of the pronoun or as the subject in the second sentence. The researchers also analysed the choice of referring expressions in the no-pronoun conditions. Collapsed across all verbs and connectives, more pronouns (relative to names) were found when the antecedent was NP1 than when it was NP2, indicating that the antecedent's position or grammatical role had an effect. However, they did not report if the effect of structural position was modulated by the completion preferences, that is, whether pronouns were more frequent for the bias-consistent than the bias-inconsistent entities.

Stevenson et al. (1994) also investigated the role of connectives on completion preferences by contrasting subordinate connectives *so* and *because* (Experiment 3) by using only no-pronoun conditions. Participants had to complete sentence fragments ending with either *so* or *because*. When action verbs (goal-source/source-goal and agent-patient/patient-agent) preceded *so*, participants tended to refer to the semantic role that was most strongly associated with the endpoint of the event (the goal or the patient). However, when *so* was replaced with *because*, such biases towards the endpoint were weakened, indicating that in addition to the verb meaning, the connective also contributes to completion preferences. Such effect

of connective was clearest with stimulus-experiencer and experiencer-stimulus verbs. When *because* followed stimulus-experiencer verbs, the stimulus was the preferred antecedent, whereas when *so* followed the verb, the experiencer was the preferred antencedent. The analyses of the choice of referring expressions showed that across verbs and connectives, the frequency of pronouns relative to names was higher when the antecedent was NP1 than when it was NP2, indicating that the referent's structural position had an effect. However, the researchers did not examine whether such effect was modulated by completion preferences.

Most recently, Fukumura and Van Gompel (2010) investigated if likelihood of reference affects the choice of referring expressions by using two written sentence completion methods. In Experiment 1, they contrasted stimulus- experiencer and experiencer-stimulus role verbs (Au, 1986; R. Brown & Fish, 1983; Stevenson et al., 1994) as in (43).

43a. Gary scared Anna after the long discussion ended in a row. This was because ..

43b. Gary feared Anna after the long discussion ended in a row. This was because ..

In the stimulus-experiencer verb condition (43a), *Gary* (NP1) is the stimulus, whereas *Anna* (NP2) is the experiencer. In contrast, in the experiencer-stimulus verb condition (43b), the semantic roles are reversed. According to previous research (Au, 1986; R. Brown & Fish, 1983; Stevenson et al., 1994), the stimulus role is preferred as the referent over the experiencer role. If the likelihood of reference has an effect, pronouns (relative to repeated names) should be more frequent to refer to the stimulus than the experiencer. Note that these verbs have an advantage over the goal-source/source-goal verbs used by Arnold (2001) in that the argument status of the

semantic roles is better controlled (the stimulus and experiencer are both obligatory arguments).

In the first test, the choice of referring expressions was examined while participants were free to choose which NP to refer to (*free completion method*), like in Arnold (2001) and Stevenson et al. (1994). In the second test, the researchers selected materials that showed a strong stimulus bias in the first test and asked participants to produce completions by referring to either NP1 or NP2 as indicated by an arrow as in (44) (*constrained completion method*). This allowed them to obtain enough observations for the less preferred referent without compromising the strength of semantic biases.

▼
44a. Gary scared Anna after the long discussion ended in a row. This was because ..

▼
44b. Gary scared Anna after the long discussion ended in a row. This was because ..

▼
44c. Gary feared Anna after the long discussion ended in a row. This was because ..

▼
44d. Gary feared Anna after the long discussion ended in a row. This was because ..

The results from the free completion test showed that following (43a), participants referred to NP1 (Gary) as the subject in their continuation of the second sentence fragment (*This is because …*) more frequently than NP2 (Anna), whereas following (43b), participants tended to refer the object more frequently than the subject. That is, participants referred to the stimulus (Gary in 43a, Anna in 43b) more often in both verb conditions, consistent with previous studies (Au, 1986; Brown & Fish, 1983; Stevenson et al., 1995). Crucially, participants did not produce

any more pronouns to refer to the stimulus than the experiencer. Overall, more pronouns (relative to repeated names) were found for NP1 than NP2. Importantly, such NP1 advantage was not modulated by the semantics of the verb, however. The same pattern of results was found with the constrained completion method: While the antecedent's structural position had an effect, no effect of likelihood of reference was found. In Experiment 2, they contrasted the semantics of the connectives (*so* versus *because*) (Stevenson et al., 1994). Although the semantics of connectives influenced the likelihood of reference in the subsequent clause, such completion preferences did not have an effect on how people referred to the discourse entities.

The question is why structural properties of the antecedent had an effect, whereas the semantic biases did not. Fukumura and Van Gompel argued that the referent's structural properties in the preceding sentence influence the choice of anaphor, because language users vary sentence structure depending on the accessibility of discourse entities (Bock & Irwin, 1980; Ferreira & Yoshita, 2003; Prat-Sala & Branigan, 2000). For instance, using a written sentence recall task, Bock and Irwin (1980) found that across different syntactic variations such as active versus passive contrasts (*The eye doctor examined the sailor* versus *The sailor was examined by the eye doctor*) and dative alternations (*The rancher sold the cowboy the horse* versus *The rancher sold the horse to the cowboy*), participants tended to choose a sentence structure that allowed an entity that was mentioned in the prior sentence to precede an entity that was not. Similarly, using a spoken sentence recall task, Ferreira and Yoshita (2003) found that Japanese dative alternations were affected by the referent's prior mention in the preceding sentence. Furthermore, Prat-Sala and Branigan (2000), who used a picture description task in Spanish, found both the likelihood of producing passive constructions like (45a) or dislocated active

sentences like (45c) (relative to all alternatives including active sentences like 45b) was affected by whether an entity representing the patient role (e.g., the woman) was made salient by the preceding discourse. This indicates that the referent's prominence in the preceding discourse influenced both grammatical function assignment and word order in the subsequent sentence.

45a. La mujer fué atropellada por el tren. "The woman was run over by the train."

45b. El tren atropelló a la mujer. "The train ran over the woman."

45c. A la mujer la atropelló el tren. to the woman she ran over the train (“The train ran over the woman.”)

Fukumura and Van Gompel (2010) argued that because the structural position of an entity in an utterance varies in accordance with its accessibility, the referent's structural position in the preceding sentence serves as a processing cue for language users to determine the referent’s level of salience in the discourse. In contrast, the semantics of the preceding sentence does not provide the same kind of cue, because language users do not vary the semantics of a sentence depending on an entity's prominence. For instance, when John is salient in the discourse, people may say *John feared Anna* or *John was scared by Anna* such that John is assigned to NP1, but they do not produce *John scared Anna* or *Anna feared John* (John = stimulus, Anna = experiencer) when they actually intend to mean *John feared Anna* or *Anna scared John* or (John = experiencer, Anna = stimulus). Therefore, what semantic role language users assign to each discourse entity is independent from how salient or accessible it is to them. Therefore, the semantic role of the antecedent in the preceding sentence or semantic biases associated with it does not cue language users

to represent the bias-consistent semantic role more prominently than the bias-inconsistent entity in their memory. In contrast, the referent's structural position in the preceding sentence does influence the level of its prominence in the language user's memory representation.

An important question is why Arnold (2001) found an effect of the referent's semantic role, whereas Fukumura and Van Gompel (2010) did not. First, we may wonder if the different patterns of results found between Arnold (2001) and Fukumura and Van Gompel (2010) are related to the fact that Arnold (2001) used spoken sentence production, whereas Fukumura and Van Gompel (2010) used written sentence production. There may be certain differences between the two modalities, especially in terms of the speed of production and the degree of monitoring involved: People may take less time to produce the same sentence during speaking rather than during writing, presumably because they are more pressured to produce utterances as quickly as possible during speaking. Despite such differences, however, the two modalities have shown similar sensitivity to the factors that have been shown to influence accessibility. Pronouns (relative to names or full noun phrases) were found to be more frequent for the first-mentioned subject than the later mentioned object during both writing (Fukumura & Van Gompel, 2010; Stevenson et al. 1995) and speaking (Arnold, 2001). Similarly, the effect of accessibility on the choice of syntactic structure was found during both writing (Bock & Irwin, 1980) and speaking (Ferreira & Yoshita, 2003; Prat-Sala & Branigan, 2000). Thus, it is unlikely that the lack of the likelihood effects in Fukumura and Van Gompel (2010) was due to their written sentence production method. If anything, the chance of finding an effect of semantic biases may be higher during writing, when the time pressure for producing an utterance is

presumably less than during speaking so that language users have more time to determine what the bias is.

Fukumura and Van Gompel argued that the results from Arnold are not entirely conclusive; it is not clear whether the goal advantage in the choice of expression found by Arnold (2001) was indeed due to the likelihood of reference to particular semantic roles. For instance, the source-goal and goal-source conditions in Arnold (2010) differed not only in the order of the semantic roles, but also in other respects. In (39), the contexts preceding the source-goal and goal-source sentences were different between conditions, the entity that was being transferred differed (e.g., an abstract entity in 39a, a concrete entity in 39b), and the final phrase was different (*two days before Christmas* in 39a, the goal noun in 39b). Furthermore, the argument status of the prepositional phrase was different between the conditions: In (39b) *to Brendan* is an obligatory argument, whereas in (39a) *from Eduardo* is not. Therefore, it is possible that Arnold's findings may have resulted from these other, uncontrolled variables. In fact, comparison of the reported means suggest that this is very likely. In her study, the goal bias in the completions was larger when the antecedent was the subject than the oblique object. However, the semantic bias effect on the choice of referring expression was smaller (and may not have been significant) with the subject than with the oblique object. If the semantic effect on the choice of referring expression is driven by likelihood of reference, as claimed by Arnold (2001, 2008), the effect should have been strongest with the grammatical role that showed the strongest goal bias. It may be that the goal advantage in her study was primarily affected by the different argument status of the oblique object.

Another alternative explanation for Arnold's (2001) results is related to the fact that, unlike in Fukumura and Van Gompel (2010), there was no connective in

Arnold's experiment. This means that the semantic relationship between the antecedent and the anaphor sentences (often called *coherence relationship*) was not controlled. For instance, participants could produce different completions that had causal or consequential relationships with the previous sentence. Following *Lisa gave the leftover pie to Brendan*, they may like to describe events that explain why Lisa did what she did (e.g., Lisa wanted to please Brendan) or events that occurred as a consequence of Lisa's action (e.g., Brendan was happy). In fact, Arnold showed that there was a systematic pattern between the types of completions participants produced and reference to certain semantic roles. Her analyses showed that when completions described consequences or were narrative continuations from the event in the preceding clause, participants typically referred to the goal, whereas when completions described causes of the event in the preceding clause, they typically referred to the source. It might be that participants produced more pronouns for the goal than the source, because participants generally produced more pronouns when they described consequences rather than causes of the events depicted in the preceding sentences. That is, the goal bias in the choice of expression might have been due to a preference to use more pronouns when referring to the consequence rather than the cause of an event. Why this should be the case is not very clear, though, and we need to experimentally manipulate the semantic relations between the antecedent and the anaphor sentences to establish if they indeed have an effect on the choice of referring expressions.

Summary

Chapter 1 has reviewed major functional linguistic theories (Ariel, 1990; Givón, 1983a; Gundel et al., 1993) that explained the form of reference in relation to the referent's cognitive status in the language user's memory representation: The more salient the antecedent is in the prior linguistic context (and hence the more accessible its representation is in memory), the less explicit referring expressions tend to be used. The formulation of these accounts was led by corpus analyses (Ariel, 1990; Givón, 1983a), which showed that the textual distance from the referent's previous mention affects the explicitness of the referring expressions language users use. The accounts were also informed by early experimental work, which identified other factors such as the number of intervening characters mentioned in the prior discourse (Clancy, 1980; Fletcher, 1984) and episodic distance from the referent's prior mention (Anderson et al., 1983). Studies on the preference for referential forms were further advanced by Centering theory (Grosz et al., 1995), which was originally developed by computational linguists and inspired a series of psycholinguistic investigations in comprehension (Gordon et al., 1993; Gordon & Chan, 1995) and in production (Arnold, 2001; Brennan, 1995; Fukumura & Van Gompel, 2010; Stevenson et al., 1994), showing that the preference of a pronoun over a repeated name or noun phrase is affected by the referent's structural properties: Pronouns are more frequent when referring to sentence initial subjects than later mentioned objects.

What is characteristic about all these studies is that they exclusively focused on the prior linguistic context as the determinant of the referent's salience or accessibility. Chapter 3 will therefore discuss whether and how the referent's salience in the visual context influences the choice of referring expressions and

Chapter 6 will examine if the referent's inherent saliency due to animacy affects the choice of referring expression. But before that, I will first review another research tradition, where the choice of referring expressions has been investigated in relation to the speaker's cooperativeness to facilitate the addressee's comprehension.

Audience design

The ultimate goal of reference is to identify the intended referent to the addressee. Chapter 2 discusses theories and studies that have examined whether and how the production of different referring expressions is affected by the speaker's communicative concern about the addressee's comprehension (or *audience design*).

Common ground theory

The influential pragmatic theory of Grice (1975) regards language communication as a cooperative endeavour between the interlocutors. The idea is that both the speaker and the addressee are expected to be mutually cooperative for communication to succeed, and how speakers refer is constrained by mutual expectations of cooperativeness. For example, speakers are expected by their addressee to adhere to the Maxim of Quantity, which states "Make your contribution as informative as is required", and crucially, they are not expected to be "more informative than is required" (Grice, 1975, p. 45). This is because providing more information than necessary will confuse the addressee by implying that additional information might mean something when it does not. Furthermore, his Maxim of Manner claims that speakers are expected to deliver their utterances in a *maximally effective manner* by avoiding obscure or ambiguous expressions and being concise and orderly. Clark and his colleagues (Clark, 1996; Clark & Carlson, 1982; Clark & Marshall, 1981; Clark & Wilkes-Gibbs, 1986) elaborated Grice's cooperativeness principle and conversational implicatures by arguing that interlocutors take into

account information that is commonly shared with their partner, that is, *common ground* or *mutual knowledge*.

As Schiffer (1972) argued, computing mutual knowledge is potentially infinitely complex. Taking into account what the partner knows is not enough, because it merely represents one's *individual* knowledge about the other's knowledge. To determine if a particular piece of information is *mutually* shared, A must know that *both A and B know that they share that information*. That is, A must know that B also knows that A knows that B has the knowledge that A knows that information and so on. Inspired by the insights of game theory, including Lewis (1969) and Schelling (1960), Clark and Marshall (1981) therefore proposed what they called *copresence heuristics*, which allows interlocutors to infer that particular information is mutually shared based on circumstantial evidence that the referent is co-present between the interlocutors (*triple copresence*). For example, Clark and Marshall argued that based on the fact that the interlocutors belong to the same community, they could safely expect certain facts to be in the shared knowledge (*community membership*). Also, the fact that the referent can be seen by both interlocutors (*physical copresence*) or has been mentioned in the prior linguistic context (*linguistic copresence*) provides evidence that its existence is mutually shared. According to Clark and Marshall, it is this type of interlocutors' mutual knowledge, beliefs and presuppositions that influences the choice of referring expressions. For instance, deictic referring expressions such as *this* or *that person* are used when the referent is physically co-present and speakers want to draw the addressee's attention to this fact. In contrast, anaphoric expressions such as pronouns and definite noun phrases are used to refer to an entity already established by

linguistic copresence. Proper names are used to refer to entities that are shared by community membership.

Person-specificity

Evidence that speakers take into account the shared background with their addressee comes from Isaacs and Clark (1987), who found that speakers take into account the addressee's expertise when using proper names. Whilst most New Yorkers know what the *Citicorp building* looks like, those who are not familiar with New York City landmarks do not. Isaacs and Clark showed that speakers tend to use fewer names and more definite descriptions when their addressee is not a New Yorker (non-expert) than when s/he is a New Yorker (expert). Pairs of participants were given two identical sets of 16 postcards of New York City and participants who played the speaker's role described the postcards to their partner, who then had to identify the cards and arrange them in the order the speaker described. The speaker's order of description was specified in advance, and they had to perform the same task in six different orders. The researchers found that expert speakers (i.e., New Yorkers) used proper names such as *Citicorp building* more often than novice speakers, demonstrating their expert knowledge of local landmarks. However, they used proper names much less often when their addressee was not a New Yorker. The same adaptations were found with novice speakers: They used even fewer names when their addressee was also a novice rather than an expert, indicating that speakers generally avoided names that were not known to the addressee. Furthermore, while expert speakers produced increasingly fewer names for non-expert addressees as the experiment progressed, they did not show such adaptations when the addressee was

an expert. In contrast, the use of proper names by non-expert speakers increased for expert addressees over time, while it did not change for novice speakers. Similarly, Fussell and Krauss (1992) suggested that whether speakers provide additional descriptive information together with names is related to the addressee's assumed recognisability of the referent (or the name), though their experiment found that speakers did not take into account the referent's recognisability for their addressees, suggesting that instead speakers' own recognisability of the referent affected the use of names.

Figure 1. *Example tangram used in Clark & Wilkes-Gibbs (1986)*

Other research has found addressee adaptations during the use of non-conventional names. When speakers had to identify novel abstract objects to their addressee, speakers typically produced lengthy descriptions initially, but after repeated reference, their descriptions became much shorter until a set of fixed referring expressions started being repeated as if they were a name (e.g., Carroll, 1980; Clark & Wilkes-Gibbs, 1986; Horton & Gerrig, 2005b; Krauss, Garlock, Bricker, & McMahon, 1977; Krauss & Weinheimer, 1964; 1966). For instance, to refer to the object in Figure (1), a speaker started her conversation by saying *the next one looks like a person who's ice skating, except they're sticking two arms out in front*. When she referred to the same object next time, she described the same figure

as *the next one's the person ice skating that has two arms* and over time, her descriptions became shorter and shorter until she started repeating a short phrase like *the ice skater*. Clark and Wilkes-Gibbs (1986) argued that this shortening of expression arose from collaboration between the interlocutors during conversations. When referring to an entity for the first time, a speaker proposes their conceptual perspective on that object to the addressee. Once the addressee accepts the initial reference (i.e., they identify the referent), the speaker assumes that a common perspective is established with their addressee and they can re-use the same description for the same referent in the future. Because the addressee can also use their common perspective to interpret the reference, the speaker is less likely to be asked to expand on, repair or replace her descriptions by the addressee, which would allow the gradual shortening of the expression.

However, the extent to which the interlocutors' collaboration drives the shortening of referring expressions is not very clear, because after repeated reference, speakers may become more familiar with the referent and increasingly efficient in their word choice, which may cause the shortening of the expression. Indeed, Garrod and Anderson (1987) have suggested that the repetitive use of a set of referring expressions may have been due to the speakers' conformity to *local consistency.* They analysed the type of descriptions speakers used to identify positions during maze games, which showed that although there were different ways of describing a position in the maze, speakers became increasingly repetitive in the choice of descriptive schemas. According to the collaborative view of language use (e.g., Brennan & Clark, 1996; Clark & Wilkes-Gibbs, 1986; Wilkes-Gibbs & Clark, 1992), such repetition in descriptive schemas arose as a result of the cooperation between the interlocutors to establish a mutually acceptable perspective. In contrast,

Garrod and Anderson argued that the reduction in referential forms resulted from the fact that interlocutors reused the same descriptive schemas that were recently produced by their partner (*output/input coordination*) because they were easier to produce than novel descriptions.

More recently, Pickering and Garrod (2004) argued that during dialogues linguistic representations of the interlocutors become assimilated through automatic *alignment*, and deliberate audience design only takes an effect when simpler mechanisms fail to achieve alignment. Although this alignment model is primarily concerned with the interlocutors' representations during dialogues where they both play speaker's and addressee's roles, the same mechanism may apply to speech without turn-takings: Speakers may preferentially repeat the same type of descriptions because they are primed by their own speech, not because they try to adhere to the cooperativeness principle. According to this model, the interlocutors do not need to deliberately negotiate how they should conceptualise a particular piece of information, because they simply follow the precedent that is available in their memory.

Therefore, for the collaborative view of language use, it is necessary to demonstrate how the speaker's referential choice is modulated by the addressee's knowledge. Krauss and Weinheimer (1966) may be one of the earliest who investigated the role of the addressee's feedback in the shortening of referring expressions. The researchers were also one of the earliest who used a referential communication task, in which speakers had to identify abstract figures to an addressee who was sitting in a separate booth. In one condition, addressees were allowed to freely interact with the speaker, whereas in another condition, they were not. In both conditions, after each trial, a machine notified speakers as to whether

their addressee successfully identified the referent. Half of the speakers were told that the addressee identified the target in 50% of the trials, whereas the other half was told that the addressee always identified the target (100%). Their analyses showed that the decline in the number of words used by the speaker for each trial was larger when the addressee was allowed to give feedback than otherwise, suggesting that the addressee's feedback resulted in a shortening of referring expressions. Interestingly, the feedback from the machine also had a similar effect as the feedback from a real addressee. The reduction in reference forms was greater when the machine indicated that the addressee always identified the target than when the addressee was successful in only 50% of the trials, suggesting that what facilitates speakers' efficiency is the confirmation of the felicity of their past reference, which could be provided by a machine rather than a real addressee.

Stronger evidence for the collaborative view of language use comes from Wilkes-Gibbs and Clark (1992), who investigated if speakers take into account the identity of their addressee. As in Clark and Wilkes-Gibbs (1986) and Krauss and Weinheimer (1966), speakers used fewer and fewer words after repeated reference to describe non-conventional figures. Crucially, when speaking to a new addressee, their descriptions became elaborate again, but they were nevertheless less elaborate compared to when they themselves referred to the figure for the first time. The results thus suggested that although the speaker's own efficiency in description or familiarity with the figure contributes to the reduction in the number of words used in their descriptions, speakers do take into account the addressee's familiarity with the expression or the referent. Indeed, the speaker's increased wordiness after the addressee change was smaller when the second addressee was present as a side participant in the initial trials rather than when the addressee was observing the

initial trials from a separate room or when the addressee was present in the same room but could not see the figures or had no access to the initial trials at all. Thus, the results suggest that the speaker's belief about common ground with a particular addressee contributes to increased referential efficiency.

Brennan and Clark (1996) argued that when the speaker makes a reference and the addressee accepts it, they form what they call a *conceptual pact,* a provisional concord on how the referent is to be conceptualised. According to the collaborative view of language use (Clark & Schaefer, 1987, 1989; Clark & Wilkes-Gibbs, 1986; Schober & Clark, 1989), speakers must choose referring expressions based on the mutually agreed conceptual ground when they re-refer to the same object. In other words, if speakers talk to a new addressee, they establish a new agreement with the addressee and abandon the previous conceptual pact formed with the previous addressee. They tested this hypothesis by investigating the choice between basic terms (e.g., *shoe*) and subordinate terms (*loafer*) during a referential communication task. Speakers were more likely to use subordinate terms such as the *loafer* if the referential context contained more than one shoe. But after producing subordinate terms, speakers were more likely to use subordinate referring expressions even when there was no other shoe than the referent in the referential context, which was regarded as an effect of conceptual pact or *lexical entrainment* (Garrod & Anderson, 1987). The critical manipulation was made to the identity of the addressee. In one condition, speakers identified the target object to the same addressee, whereas in another condition, they identified the referent to a new addressee after initially having identified the referent with a different addressee. The likelihood of repeating subordinate referring expressions was larger when speakers

talked to the same addressee than when they spoke to a different addressee, suggesting that the effect of lexical entrainment is *person-specific*.

Horton and Gerrig (2002) argued that person-specific adjustments do not occur immediately; speakers need to experience and learn the consequence of not doing so from the addressee's feedback. In the early phases of their experiment, speakers identified an array of picture cards to two addressees, each of who had a different subset of speaker's cards, and in later rounds, speakers identified the entire set of cards to only one of the two addressees (which means that some of the cards were new to the addressee). Overall, speakers avoided non-conventional referring expressions established with the prior addressee and they used more explicit referring expressions when the picture was new to the addressee, consistent with Wilkes-Gibbs and Clark (1992). However, by analysing the data more closely, the researchers revealed that such person-specific adjustments did not occur in trials that followed immediately after the change of addressee. In the very first round when speakers identified the pictures to the new addressee, they were actually *less* explicit when the pictures were new to the addressee than when they were not. Thus, Horton and Gerrig (2002) argued that to start producing expressions that are helpful for their addressee rather than those that are easiest for themselves, speakers have to be made aware of the needs of their addressee.

Horton and Gerrig (2005a) argued that the effects that have been ascribed to the speaker's deliberate audience design may be the by-product of general memory search involved in topic selection. When selecting conversational topics, speakers are cued by the addressee's identity to retrieve information associated with the addressee, and these associative memories reveal what information is shared with the addressee such that speakers need not consider whether the referent is shared or not

when formulating referring expressions. For instance, the addressee may remind the speaker about a trip they recently took together as well as the friends they went with, and the speaker may start talking about one of those friends: “Have you already seen Peter’s new car?” When formulating a referring expression to refer to Peter, the speaker does not need to explicitly consider if Peter is in the common ground knowledge of the interlocutors, because he is already represented as mutually shared information in the speaker’s message. Therefore, speakers do not need to strategically seek evidence of common ground to choose a particular referring expression (contra Clark & Marshall, 1981). Whether a particular piece of information is shared or not becomes clear during message selection.

Horton and Gerrig’s (2005a) account is different from Pickering and Garrod (2004), who also proposed resource-free audience design. According to Pickering and Garrod, person-specific adaptations are possible, because of alignment of linguistic representations through interlocutors’ interactions. In contrast, Horton and Gerrig argued that whether a piece of information constrains language production processes depends upon the strength of partner-specific associations represented in the speaker’s memory. If the associations are strong enough, partner-specific adaptations are possible without costing memory resources.

The importance of salience of the addressee-relevant information is highlighted by the results of Horton and Gerrig (2005b). Speakers described cards to two addressees who had to rearrange the cards such that they were in the same order as in the speakers' array of cards. Each addressee dealt with eight cards. In the *orthogonal* card condition, the addressees saw different sets of cards, each having four cards of two different semantic categories (e.g., one addressee had four cards of birds and four cards of dogs, whereas the other addressee had four cards of fish and

four cards of frogs). In the *overlapping* condition, both speakers and addressees saw exactly the same set of eight cards, each having two cards of four different categories (e.g., both addressees dealt with two dogs, two birds, two fish, and two frogs). They predicted that taking into account the addressee's knowledge would be easier in the orthogonal condition, where the two addressees had distinct sets of cards, than in the overlapping condition, where both had the same cards. Speakers took longer to initiate descriptions when the cards were new to their addressee, and they provided more specific referring expressions when the cards were new to their addressee, which provided evidence for audience design. Crucially, however, this effect of audience design was larger in the orthogonal condition than in the overlapping condition, which indicated that audience design was easier when particular categories can be associated with a particular addressee. Furthermore, they found that the average initiation times were the same between the orthogonal and the overlapping conditions, which indicated that speakers did not make extra efforts to take into account the addressee's knowledge in the overlapping condition. Thus, the researchers argued that "language use is opportunistic, using whatever information is most accessible within the time course necessary for utterance planning." (p.130)

Wu and Keysar (2007) reported similar findings. They showed that when the interlocutors share a high degree of information, speakers tend to overestimate the addressee’s knowledge. In a study phase, the experimenter named 24 abstract figures, which were presented individually on a computer screen, and both the speaker and the addressee had to memorize the names. In the high overlapping condition, the addressee left the learning session after 18 names and the speaker had to memorize the remaining six names alone, whereas in the low overlapping condition, the speaker and the addressee learned only six names together and the

speaker memorised 18 names on her own. The question was how the varied degree of overlapping information influenced the speaker's use of names (relative to more complex descriptions) when the speaker had to identify all 24 figures to the addressee during a subsequent test phase. Although speakers generally avoided using names to refer to objects that were new to their addressee, speakers who shared more names with the addressee (high overlap) produced more names when referring to objects that were new to the addressee than those who shared few names with the addressee (low ovelap). The results thus suggested that when speakers know they share most information with the addressee, they use their own perspective as a proxy of the addressee's, showing less sensitivity to the addressee's knowledge about each referent. Such strategy could hinder communication effectiveness when names are not shared with the addressee. Indeed, while addressees asked clarification questions less frequently in the high than low overlap condition when the objects (and the names) were shared with the addressee, addressees asked *more* clarification questions in the high than low overlap condition when the objects and names were new to the addressee, perhaps because speakers used more names in the high than low overlap conditions.

Ambiguity avoidance and utterance planning

So far, I have reviewed studies that focused on referential behaviour that evolved over the course of the conversation. Below I will discuss studies that investigated how speakers produce referring expressions that are helpful to the addressee during a "one-shot" utterance (i.e., without the addressee's explicit feedback). When referring to an entity in a context with alternative entities, speakers need to choose referring

expressions that distinguish the referent from other referential candidates (or competitors) (Olson, 1970). For instance, if a speaker wants her addressee to pick up a specific book from several books on a shelf, using a bare noun such as "the book" is infelicitous, because it does not specify which book should be picked up. Thus, for successful reference, speakers need to determine what properties distinguish the referent from competitors in the referential context and encode such information in the referring expression they produce. The problem is that speakers need to produce their utterances within a reasonable time frame. If speakers take too long before speaking, the transmission of information would be delayed or the speech may get interrupted, which in turn jeopardises any effect that the speech intends to achieve. Given the time constraints in utterance planning, how do speakers use contextual information in order to produce referring expressions that are communicative?

Ferreira, Slevc, and Rogers (2005) argued that whether speakers can successfully avoid referential ambiguity depends on whether ambiguity can be detected before production processes start. Models of language production (e.g., Bock & Levelt, 1994; Levelt, 1989) assume that language production is initiated by the formulation of a meaning or a concept the speaker wants to express, which serves as input for subsequent linguistic encoding, including the selection of syntactically-specified lexical representations (called *lemmas*) and the retrieval of phonological representations (called *lexemes*). Ferreira et al. argued that ambiguity is relatively easy to avoid when it can be detected during conceptual planning, because the information encoded in the conceptual representation will be automatically passed onto the linguistic encoding processes. For instance, when referring to a flying bat in a referential context in which a smaller flying bat is also present, speakers may realise potential ambiguity based on the shared conceptual representations of the two

flying mammals. As a result, they may encode information that distinguishes the referent from the competitor (e.g., size) in their message representations, which will lead to the production of a modified noun phrase (e.g., *the small bat*) that expresses the relative size of the referent in the context rather than a bare noun (e.g., *the bat*). In contrast, ambiguity that cannot be detected on the basis of conceptual representations is much harder to avoid. This is because information that is not encoded in conceptual representations is not linguistically expressed, so in order to avoid producing ambiguous expressions, speakers first need to formulate the expression and then somehow come to realise that the to-be-produced word maps onto a competitor, before they work on the production of an alternative expression. For instance, *the bat* could refer to a flying bat as well as a baseball bat, but because the baseball bat has a different semantic category from the flying bat, it is hard to realise if the category term that refers to the baseball bat has the same phonological representation as the flying bat unless the lexeme for at least one of the entities is retrieved. To avoid ambiguity, therefore, speakers need to retrieve the word form for the flying bat and recognise that the word could also refer to the baseball bat. This is a fairly complex process, because it involves monitoring one's inner speech, which has been argued to pose a high processing demand (e.g., Levelt, 1989).

Ferreira et al. found that while participants hardly ever (in 1% of cases) produced ambiguous bare nouns (e.g., *the bat* to refer to a flying mammal) when the referential competitor shared the same conceptual representation (e.g., a flying mammal that contrasted in size), they often produced ambiguous bare nouns when the competitor had a different conceptual representation but shared the same phonological representation (e.g., *the bat* is homophonic with a baseball bat) (in 50% of cases), though the rate was significantly less than in the control condition, where

bare nouns were unambiguous (in 65% of cases). Thus, the results suggest that speakers avoid ambiguous referring expressions more effectively when potential ambiguity can be detected before production processes start than when it requires the explicit assessment of the to-be-produced referring expression.

Brown-Schmidt and Tanenhaus (2006) used the visual world eye-tracking technique (Cooper, 1974; Tanenhaus, Spivey Knowlton, Eberhard, & Sedivy, 1995) to investigate how and when speakers incorporate the presence of a referential competitor when they produce a scalar adjective during a referential communication task. They found that when an adjective preceded the noun in a pre-nominal adjective noun phrase (e.g., *the small square*), the speaker's average first fixation to the size contrast (e.g., a larger square) was 605 ms before the onset of the noun. In contrast, when the adjective followed the noun in a post-nominal repair (e.g., *the square …uh small one*), the fixation occurred 88 ms *after* the onset of the noun. The results suggested that early fixations to the size contrast resulted in pre-nominal modifiers, whereas post-nominal repairs were more frequent if fixations to the contrast were late. Furthermore, the utterance onset tended to be slower with pre-nominal modifiers (1546 ms) than post-nominal repairs (1061 ms), which is consistent with the idea that when speakers produced post-nominal repairs, the presence of a size-contrast was not incorporated into utterance planning, whereas when they produced pre-nominal adjectives, it was. Brown-Schmidt and Tanenhaus argued that the interface between message planning and utterance planning is incremental in that contextually relevant information is passed onto utterance planning as soon as that information becomes available in the message representation.

Brown-Schmidt and Konopka (2008) followed up the results of Brown-Schmidt and Tanenhaus (2006) by investigating the scope of message encoding by contrasting Spanish and English. Unlike in English, scalar adjectives always follow the noun in Spanish (*la mariposa pequeña* for *the small butterfly*). They examined if message encoding proceeds incrementally to the extent that the position of the size adjective determines when the speaker conceives the presence of a size-contrast. The results showed that Spanish-English bilinguals fixated a size contrast earlier when producing a pre-nominal modifier in English (482 ms before the noun onset) than a post-nominal modifier in Spanish (108 ms before the noun onset). The researchers argued that message encoding is highly incremental such that the scope of message encoding is lexically determined. That is, when speaking in Spanish, speakers encode the presence of a referential competitor *later* (relative to the noun phrase onset) than when speaking in English, because the size adjective that refers to the referential competitor occurs later in Spanish. However, although this is an interesting interpretation, the researchers crucially assume that the fixation reflects message encoding. As suggested by Griffin and Bock (2000), speakers may decide whether to include a particular piece of information in their message without fixating the relevant object and such decision could be done holistically rather than sequentially. In fact, it is possible that the fixation to a referential competitor is driven by the linguistic processing that followed message encoding: Speakers fixated at a referential contrast earlier in English than in Spanish, because they had to produce a scalar adjective earlier in English than in Spanish. That is, eye movements may reflect the order in which speakers produce words, not the timing with which they plan conceptual information. Speakers of different languages might therefore

encode their message representations in a similar way, but differ with respect to when they produce the words.

Audience design and utterance planning

One of the most controversial issues in current psycholinguistic research is whether language production is affected by ease of comprehension rather than by ease of production and in particular, whether speakers avoid ambiguity for their addressee. In the domain of syntactic ambiguity avoidance, where some research has suggested that speakers often do not avoid syntactic ambiguity (Allbritton, McKoon, & Ratcliff, 1996; Arnold, Wasow, Asudeh, & Alrenga, 2004; Ferreira & Dell, 2000), the issue has been highly controversial. Some researchers have argued that speakers avoid syntactic ambiguity when the context does not disambiguate (Haywood, Pickering, & Branigan, 2005; Snedeker & Trueswell, 2003), whereas others have argued that speakers avoid syntactic ambiguity whether or not the context makes the sentence ambiguous (Kraljic & Brennan, 2005; Schafer, Speer, Warren, & White, 2000), that is, syntactic ambiguity avoidance is driven by production-internal syntactic representations. For instance, when the context supports more than one interpretation, speakers themselves may experience ambiguity, which may affect how they formulate the syntactic structure of their utterance. In fact, when no contextual information is available about ambiguity, speakers often do not avoid syntactic ambiguity (Allbritton, et al., 1996; Arnold, et al., 2004; Ferreira & Dell, 2000). In the domain of referential ambiguity, where much research has shown that speakers avoid referential ambiguity (e.g., *the large circle* rather than *the circle* in the context of more than one circle, Brown-Schmidt & Tanenhaus, 2006; Ferreira et al., 2005;

Horton & Keysar, 1996; Sedivy, 2003 amongst many), one of the main issues has been the way in which speakers take into account the addressee's needs during utterance planning.

Brown and Dell (1987; Dell & Brown, 1991) examined if the addressee's knowledge status influences how speakers describe typical or atypical events depicted in pictures. When describing the event of a robber stabbing a man, speakers were more likely to mention an atypical instrument such as *icepick* than a typical instrument such as *knife*. But whether the pictures were also seen by the addressee had no effect on the instrument typicality effect. The only reliable evidence of audience design was found when participants produced repairs. After describing the main action, participants more frequently mentioned atypical instruments (e.g., *The robber stabbed the man. He used an ice pick*) when they knew that the addressee did not have the picture than when they knew that the addressee had the picture. Therefore, Brown and Dell concluded that the speaker's knowledge of what the addressee knows or does not know (or "the model of the listener") does not affect early production processes, and audience design arises as an utterance repair. That is, language production proceeds egocentrically, irrespective of the addressee's knowledge status, but speakers use the comprehension system to monitor their utterance and adjust the infelicity of their utterance (*monitoring and adjustment hypothesis*).

However, Lockridge and Brennan (2002) argued that Brown and Dell (1987) found no evidence of audience design because the addressee was a confederate rather than a genuine participant. Using a naïve addressee, they found that the effect of instrument typicality occurred only when the addressee did not see the picture, and speakers were more likely to mention typical rather than atypical instruments within

the same clause as the target action. Thus, they argued that audience design can influence early speech production processes if the speaker believes that the addressee's needs are real. However, because Lockbridge and Brennan did not test the condition where a confederate played the addressee's role, their study provided no evidence that the effect of audience design is modulated by the identity of the addressee, and there may be other factors that explain the discrepancies between their study and Brown and Dell (1987). For instance, in Lockbridge and Brennan, the effect of audience design was found when the speaker and the addressee sat close together facing a single picture, but not when the addressee saw a separate copy of the same picture and sat in isolation from the speaker, a setting that is more comparable to that used in Brown and Dell. Therefore, successful addressee adaptations may depend on how salient the addressee's knowledge is to the speaker rather than whether the addressee is a confederate or not.

Inspired by Brown and Dell's (1987) monitoring and adjustment hypothesis, Horton and Keysar (1996) investigated whether common ground knowledge influences early or late stages of production processes when speakers avoid ambiguous referring expressions. In a referential communication task, participants described a moving object appearing on a computer screen so that their addressee (a confederate) could identify it. The computer screen was divided into halves, and the target object always appeared on the speaker's side first and moved to the addressee's side. Participants had to identify a target object that was always the top most object in the context (e.g., the small circle in Figure 2), which contained an additional category exemplar that contrasted in size or colour with the target (referential competitor) (e.g., the large circle in Figure 2). Half of the participants were told that the addressee (confederate) would always see the same competitor

(*shared-context* condition) (Figure 2a), while the other half of the participants were told that the addressee could never see anything other than the target object (*privileged-context* condition) (Figure 2b). If speakers use common ground, the use of restrictive modifiers that contrast the referent with the competitor should be more frequent in the shared-context condition than in the privileged-context condition. Furthermore, Horton and Keysar examined if common ground influences the earlier or later stages of production processes. Within each shared and privileged context group, participants were further divided into two groups with different instructions. Half of participants were instructed to produce a reference as quickly as possible (speeded condition) and the other half were told to take as much time as they needed (non-speeded condition).

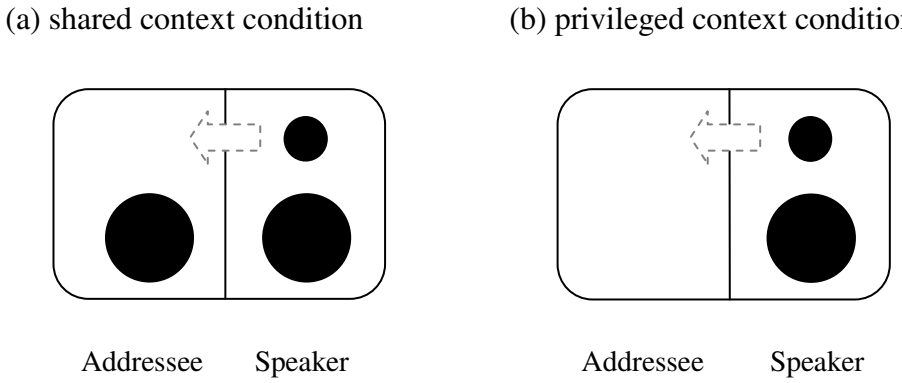

Figure 2. *Visual context manipulation in Horton & Keysar (1996)*

As predicted by the common ground hypothesis, the proportion of contrasting adjectives relative to the total number of words in the target descriptions (including non-contrasting adjectives and nouns) was higher in the shared-context condition (b)(29%) than in the privileged-context condition (a) (9%). However, such a difference was found only in the non-speeded condition. When participants were

under time pressure, they produced as many contrasting adjectives when the competitor was shared as when it was privileged to the speaker (approximately18-19%). Thus, Horton and Keysar argued that the distinction between privileged and common ground is taken into account *late* in production processes and that the initial utterance planning proceeds *egocentrically* such that speakers initially use information that is salient to themselves. The results were thus consistent with Dell and Brown's (1991) monitoring and adjustment hypothesis described earlier.

However, there are several issues with Horton and Keysar's experiment. First, in their experiment, speakers were unable to see the addressee's visual context, so they had to be explicitly told that in the shared condition, the addressee would see the competitor, whereas in the privileged condition, they would not. Therefore, in the no-speeded condition, shared-context participants may have adopted a strategy to always incorporate the presence of a referential competitor, whereas privileged-context participants may have used a strategy to always ignore competitors. That is, any difference in the use of adjectives between the two groups of participants could be due to the different strategies adopted by the participants dealing with a competitor in their own visual context. Second, the time-pressure manipulation might have biased the participants' interpretation of their task. Participants in the speeded condition were not affected by the visual context manipulation, perhaps because they thought their task was to name the target object as soon as it appeared in the privileged ground rather than to get their partner to identify it. In other words, it is possible that audience design has an early impact on the choice of referring expression under circumstances where speakers are not placed under time pressure.

Nadig and Sedivy (2002) manipulated visual perspective differently from Horton and Keysar (1996) when investigating the use of perspective-taking by

children (five years old). In one of their experiments, speakers referred to target objects in a grid while the addressee, sitting at the opposite side of the grid, had to identify them. In the shared-context condition (Figure 3a), participants had to refer to a target (a big glass) when a size-contrasting object (a smaller glass) was in the shared visual context with their addressee.

(a) shared context (b) privileged context (c) control

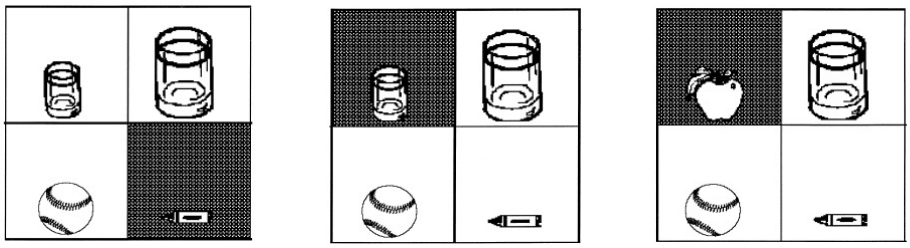

Figure 3. *Visual context manipulation in Nadig & Sedivy (2002). The dark background indicates that the object is occluded from the confederate's view.*

In the privileged-context condition (Figure 3b), the contrasting object was occluded from the addressee's visual perspective because there was a bar behind the object. In the control condition (Figure 3c), an entity from a different semantic category (an apple) was in the privileged space in the grid. They found that children used more adjectives in the shared-context condition (76%) than in the privileged-context condition (50%), suggesting that children know when disambiguation is necessary for their addressee's perspective. Interestingly, children hardly ever produced adjectives in the control condition (3%), suggesting that children were also affected by the information in the privileged context such that even when there was no ambiguity for the addressee's perspective, if their own perspective involved

ambiguity, they tended to use adjectives fairly frequently. The same pattern of results was found with adults participants. The frequency of adjectives was highest in the shared-context (100%), followed by the privileged-context (57%) and the control condition (0%), suggesting that both adults and children take into account common ground when avoiding referential ambiguity, but they often try to avoid ambiguity even when there is no ambiguity for their addressee.

Nadig and Sedivy (2002) did not investigate the time-course of the common ground effect. According to Horton and Keysar (1996), audience design emerges out of monitoring processes, so the distinction between the privileged and common ground information does not influence early production processes. Alternatively, Horton and Gerrig (2005a; 2005b) suggested that the common ground distinction may influence early production processes if the common ground distinction is salient enough to the speaker. In Nadig and Sedivy, which area of the visual display was blocked from the addressee's view is clearly marked in the speaker's visual context. So, common ground information could have an early impact on the speaker's utterance planning, because speakers know that they would never have to refer to the privileged competitors so that they may pay less attention to them. That is, shared objects are more relevant to the speaker's task so that they are more saliently represented compared to privileged competitors in their message representations.

Such an account has been put forward by Wardlow-Lane and her colleagues, who investigated the role of contextual salience in a series of experiments. In Wardlow-Lane, Groisman, and Ferreira (2006), speakers identified a target card to their addressee in a standard referential communication task, where one of the cards was occluded from the addressee's viewpoint, thus constituting a privileged ground (Figure 4). The critical manipulation was that in the *conceal* condition, speakers

were instructed not to reveal any information about the hidden object, because if the addressee correctly guessed the identity of the hidden object, the addressee would receive an additional point for a reward, whereas in the baseline condition, there was no such instruction. If the use of privileged information is under the speaker's communicative control, speakers should produce *fewer* contrastive modifiers in the conceal condition than in the baseline condition, because modified noun phrases such as *the small triangle* would reveal the identity of the concealed object by implying the presence of a contrast. Interestingly, the researchers found the opposite results. Contrastive modifiers were *more frequent* in the conceal condition than in the block condition, suggesting that the use of privileged ground is affected by its relative salience to the speaker, not by the speaker's communicative concern.

Wardlow-Lane and Ferreira (2008) showed that the effect of privileged contrasts on the speaker's use of restrictive modifiers is affected by the relevance of the privileged ground to the speaker's task. In one of their experiments, half of their participants sometimes had to refer to privileged objects during filler trials (i.e., privileged objects were relevant for their task) (*privileged-relevance* condition) while the other half never had to refer to privileged objects (i.e., privileged objects were never relevant for their task) (*privileged-ignorable* condition), though during experimental trials, both groups always referred to common ground objects only. Wardlow-Lane and Ferreira found that speakers in the privileged-relevance condition were 22% more likely to produce referring expressions that contrasted the referent with the privileged competitor than those in the privileged-ignorable condition. They also found that the addressee in the privileged-relevance condition was less successful in identifying the target compared to the privileged-ignorable condition, suggesting that the use of references that contrasted the referent to the

privileged object may have confused the addressees. It is, however, possible that speakers in the privileged-relevance condition were somewhat less sensitive to the addressee's visual context, because they often had to refer to an entity that could not be identified by the addressee. Furthermore, the addressees in the privileged-relevance condition may have misidentified the target more frequently, not necessarily because the overuse of modified NPs confused the addressee, but rather because they had to guess the identity of the hidden object and this resulted in unnatural strategies.

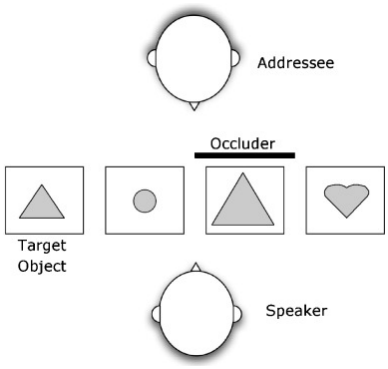

Figure 4. *Visual context manipulation in Wardlow-Lane & Ferreira (2008)*

Wardlow-Lane and Ferreira (2008) also manipulated the way speakers identified the target. In one condition, they had to identify targets amongst objects in the privileged ground. For example, to identify the target object in Figure 4, they were given a reference point such as:

2 to the left of 

In another condition, speakers referred to target objects that had an arrow directly pointing at them. They found that speakers were 5% more likely to be affected by the presence of a privileged contrast when they had to identify the target relative to the privileged contrast (as in the above example) than when an arrow directly pointed at an object as the target. The results thus suggested that the use of privileged ground is affected by its salience to the speaker: The more salient the privileged ground, the more difficult it is to ignore.

Based on these findings, it seems plausible that speakers take into account common ground information during ambiguity avoidance (Horton & Keysar, 1996; Nadig & Sedivy, 2002) because the common ground distinction affects the speaker's attention allocation. That is, speakers may pay more attention to the shared visual context than to the privileged visual context perhaps because objects in the shared ground are more task-relevant than those in the privileged ground. As a result, competitors in the shared ground may have a stronger impact during ambiguity avoidance. Whether attention allocation due to audience design affects linguistic processing has been addressed in recent comprehension research, where there has been considerable debate about the exact time course of the addressee's use of the speaker's perspective in referential communication tasks. Some have argued that the speaker's knowledge guides the addressee's reference resolution at the earliest point in time such that the visibility of a referential competitor in the speaker's perspective immediately biases the likelihood with which the addressee considers it as the referent (e.g., Hanna, Tanenhaus, & Trueswell, 2003; Tanenhaus, Spivey-Knowlton, & Hanna, 2000). In contrast, others have argued that initial comprehension processes are encapsulated from the speaker's knowledge and the use of the speaker's knowledge has an effect later when the addressee adjusts the initial interpretation

using the speaker's perspective (e.g., Keysar, Barr, Balin, & Brauner, 2000; Keysar, Barr, Balin, & Paek, 1998). That is, the addressee initially considers an object as the referent of a bare noun if the object matches the description of the expression even though they know the object is invisible to the speaker and hence cannot be the referent of the expression. Barr (2008) recently suggested that the reason why researchers have sometimes found evidence of early perspective-taking may be because the common ground distinction affects addressee's expectations about what a plausible referent is. For instance, researchers have found that even before hearing the instruction, the probability of fixations to shared objects was higher than to privileged objects, suggesting that addresses are more likely to expect shared objects as the potential referent than privileged objects (Barr, 2008; Keyar et al., 2000).

Interestingly, however, Barr (2008) found that despite the strategic focus on shared objects, during early linguistic processes, addressees were unable to incorporate the common ground distinction, and referential competitors in the privileged ground affected the addressee's fixations as much as those in the shared ground. When the speaker's reference unfolded, addressees were more likely to look at a competitor that was phonologically related to the referent (e.g., a buckle for the referring expression, *the bucket*) than a competitor that was phonologically unrelated. Crucially, however, this phonological cohort effect was not modulated by whether or not the competitor was in the privileged or in the shared ground, suggesting that early comprehension processes proceeded independently from the addressee's anticipations of what should be the possible referents.

One possibility is that in language production, speakers may also try to focus on common ground objects as possible referents more than privileged objects, but the set of referential candidates speakers initially take into account may not be

restricted by whether they are in common ground, as suggested by Horton and Keysar (1996). Another possibility is that audience design during production may work differently from perspective-taking during comprehension such that the common ground distinction could have an early influence during production processes but not comprehension processes. For example, speakers could base their message encoding on the common ground objects because the nature of the task makes the common ground objects more salient to them than the privileged objects and speakers are more likely to be affected by salient rather than non-salient information (Wardlow-Lane & Ferreira, 2008). One possible reason for this is that production processes commence with conceptual encoding, whereas comprehension processes start with phonological processing. Perhaps strategic attentional focus may modulate conceptual processing, but not phonological processing.

Summary

Chapter 2 has discussed theories and studies that explained the form of reference in relation to the speaker's cooperativeness to the addressee's comprehension. Research on dialogues has found that speakers take into account the addressee's expertise (Isaacs & Clark, 1987) or familiarity with the referent or the expression (e.g., Brennan & Clark, 1996; Wilkes-Gibbs & Clark, 1992; Horton & Gerrig, 2002; 2005b). There were three major accounts. Clark and his colleagues argued that reference is a joint activity, in which the interlocutors' adherence to the use of common ground guides the production of referring expressions (Brennan & Clark, 1996; Clark & Marshall, 1981; Clark & Wilkes-Gibbs, 1986). However, Pickering and Garrod (2004) proposed that the phenomena that have often been accounted for in terms of deliberate audience design may be explained as automatic

alignment of representations through interactive dialogue, arguing that deliberate audience adaptations are only adopted when automatic alignment has failed to produce felicitous referring expressions (cf. Brown & Dell, 1987; Dell & Brown, 1991; Horton & Keysar, 1996). Finally, Horton and Gerrig (2005a) argued that addressee-relevant information influences language production processes even without interactive processes as long as there is a strong enough cue guiding memory retrieval of addressee-relevant information. According to Horton and Gerrig (2005a), addressee-relevant information can influence early linguistic processes (if it is salient enough) because speakers retrieve addressee-specific information when they choose a relevant topic for conversation.

As I have discussed, whether and the extent to which speakers design the choice of referring expression for their addressee has been controversial. Some argue that the initial planning of reference production proceeds "egocentrically", because modelling the needs of the addressee is cognitively costly (Horton & Keysar, 2002), but others have suggested that children as young as five years old can use the addressee's knowledge (Nadig & Sedivy, 2002). The results from Wardlow-Lane et al. (2006) and Wardlow-Lane and Ferreira (2008) have suggested that whether to use a particular piece of information may not be determined by a high-level communicative concern to the addressee's comprehension but by the relevance of that information to the speaker. If privileged knowledge is relevant for the speaker's task, s/he is more likely to produce a referring expression that is affected by it.

What all these studies have in common is that they investigated audience design in cases where the addressee's knowledge affected referential ambiguity. One possibility is that audience design may have an effect because speakers are sensitive to whether their reference creates ambiguity. The effect of person-specificity has typically been reported in situations where speakers had to use unconventional

names (e.g., Horton & Gerrig, 2005b; Wilkes-Gibbs & Clark, 1992). Participants may have known that unconventional names do not straightforwardly identify the referent and can be ambiguous for the addressee if the addressee does not know what they mean. Speaker's perspective-taking has been investigated in situations where the visual context often contained a competitor from the same semantic category that made the use of bare nouns ambiguous (Horton & Keysar, 1996; Nadig & Sedivy, 2002). Speakers might have shown sensitivity to the addressee's visual context because they recognised potential ambiguity when they saw a competitor in their visual context. What is unclear is whether audience design has an effect on the choice of referring expressions when speakers do not have to use unconventional names or when the context does not affect ambiguity. Chapter 6 will therefore investigate whether the choice of pronouns and repeated noun phrases when the context does not affect ambiguity.

Salience in the visual context

Introduction

Recent psycholinguistic research has seen a growing interest in language processing in naturalistic settings and in how non-linguistic factors, in particular visual context, affect both language comprehension (Tanenhaus et al., 1995) and language production (Brown-Schmidt & Tanenhaus, 2006; Ferreira et al., 2005; Gleitman, January, Nappa, & Trueswell, 2007; Griffin & Bock, 2000). In production, an important issue is the extent to which such non-linguistic factors influence linguistic form (Bock, Irwin, Davidson, & Levelt, 2003; Gleitman et al., 2007; Griffin & Bock, 2000; Tomlin, 1997). Chapter 3 examines whether and how the choice of referring expressions is affected by linguistic and non-linguistic information when speakers refer to an entity mentioned in the preceding discourse.

Most theories of reference assume that the choice of referring expression is determined by the referent's saliency. When the referent is highly salient in the context, people tend to choose reduced expressions, but when it is contextually less salient, they tend to use more explicit referring expressions (e.g., Ariel, 1990; Chafe, 1976, 1994; Givón, 1983a; Gundel et al., 1993). Researchers have argued that speakers vary the form of referring expressions to signal the referent's information status in the discourse (e.g., Ariel, 1990; Givón, 1983a; Gundel et al., 1993). For instance, according to Centering theory (e.g., Brennan, et al., 1987; Gordon et al., 1993; Grosz et al., 1995) and many other researchers (e.g., Fletcher, 1984; Givón, 1983a), speakers use pronouns to signal topic continuity. In contrast, they use fuller

referring expressions such as names or definite noun phrases to introduce a new entity into the discourse (Gordon & Hendrick, 1998) or to signal a topic shift (Vonk et al., 1992).

Furthermore, researchers have argued that speakers choose referring expressions to facilitate the identification of the referent by the addressee (e.g., Chafe, 1994; Grice, 1975). Almor (1999) argued that when the referent is less activated, a highly informative referring expression facilitates comprehension, because it provides semantic information to reactivate the referent in the discourse model, whereas such a referring expression slows down comprehension when the referent's semantic representation is already highly active, because the unnecessary semantic information increases working memory demands. Indeed, it appears that pronouns are rarely used without an explicit linguistic antecedent in the text (Gundel, Hedberg, & Zacharski, 2005), suggesting that pronouns are less preferred than fuller noun phrases for introducing a referent into the discourse, presumably because they carry insufficient information to activate the referent.

But exactly what sources of information affect the referent's saliency in the discourse and thus speakers' choice of a referring expression? Much research has been devoted to the role of prior linguistic context on such decisions. For instance, the more recently the referent is mentioned, the more likely speakers use a reduced referring expression (Ariel, 1990; Givón, 1983a). Other factors that have been shown to affect the choice of referring expression are episodic boundary (Anderson et al., 1983; Vonk et al., 1992), the referent's structural properties in the preceding sentence (Arnold, 2001; Fletcher, 1984; Fukumura & Van Gompel, 2010; Stevenson et al., 1994), and the number of competitors in the prior linguistic context (Ariel, 1990; Arnold & Griffin, 2007; Clancy, 1980).

It is less clear whether and how speakers take into account non-linguistic information during the choice of referring expressions, and many theories of reference have not explicitly considered the role of such information. When speakers refer to an entity, the entity is often situated in a non-linguistic as well as a linguistic context, so investigating the possible role of non-linguistic information is critical for our understanding of how people choose different types of referring expressions under such conditions. According to mental models theory, developed by Johnson-Laird (1983), during discourse processing people represent the situation that the discourse is about. This representation is formed on the basis of linguistic information as well as perceptual information derived from the real or imaginary world. Also, Clark (1996) argued that discourse is a joint activity, in which people use language to achieve a common communicative goal. Hence the meaning of an utterance cannot be separated from other activities taking place in the situation. According to Clark, a discourse representation is based on communicative actions including speech as well as on the environment in which the activities take place. This suggests that the choice of referring expression may be affected not only by linguistic factors that affect saliency, but also by non-linguistic factors, such as the presence or absence of an entity in the visual context.

Indeed, there are circumstances in which speakers use non-linguistic information. Speakers are more likely to say *the small triangle* (rather than *the triangle*) when the visual context also includes a larger triangle than when it does not (e.g., Beun & Cremers, 1998; Brown-Schmidt & Tanenhaus, 2006; Ferreira et al., 2005; Olson, 1970; Sedivy, 2003). Similarly, Brennan and Clark (1996) showed that speakers used the subordinate-level expression *the loafer* (rather than the basic-level expression *the shoe*) more often when there was another shoe in the visual context

than when the loafer was the only shoe. However, these effects may have been due to ambiguity avoidance rather than because the visual context affected the salience of the referent. For example, the triangle is referentially ambiguous when the visual context contains another triangle, whereas it is unambiguous when there is no other triangle. In order to avoid such ambiguity, speakers may have produced modified noun phrases such as *the small triangle* more often when there was a same-category competitor than otherwise. Similarly, in Brennan and Clark (1996), speakers may have used *the loafer* because using *the shoe* was ambiguous in the context of another shoe. In fact, after using the subordinate term *the loafer*, speakers tended to continue using this referring expression even when the subsequent visual context did not contain any other shoe. This may suggest that because *the loafer* was unambiguous, the visual context had no effect. Thus, it is unclear whether the visual context affects the choice of referring expression when the visual context does not create ambiguity.

In addition, in these previous studies, the referent either was not introduced in the previous discourse at all, or was not mentioned in the immediately preceding sentence. In the absence of a recent linguistic context, speakers may use visual context to choose referring expressions, but whether and how speakers use visual context if the referent has been mentioned in the immediately preceding discourse (i.e., during anaphoric reference) remains to be addressed.

A recent study by Arnold and Griffin (2007) suggests that in cases where reference is unambiguous, and the referent has been referred to in the preceding sentence, visual context does not affect the choice of referring expression. In their study, they examined the effects of both linguistic mention and visual presence of a competitor on the choice between a pronoun and name. Participants saw a picture

with a male (e.g., Mickey) and female (e.g., Daisy) cartoon character, heard a context sentence such as (1a) or (1b), and repeated it:

1a. Mickey went for a walk with Daisy in the hills one day.

1b. Mickey went for a walk in the hills one day.

They then described a second picture in which Mickey looked tired. Participants produced fewer pronouns (and more repeated names) to refer to Mickey when the context sentence mentioned Daisy (1a) than otherwise (1b). This suggested that the (linguistic) mention of Daisy reduced the salience of Mickey, resulting in fewer pronouns. This extends previous findings by Fletcher (1984) who showed that the mention of a same-gender competitor in the previous context reduces the use of pronouns and zero anaphors. But more interestingly, Arnold and Griffin also found that the proportion of pronoun responses was unaffected by the visual presence of the competitor in the second picture: Participants produced as many pronouns to refer to the referent when the competitor was present in the second picture as when it was not. It is therefore possible that visual context has no effect on anaphoric reference.

However, there are several potential explanations for this lack of an effect. First, the visual manipulation may have been relatively weak: The presence of Daisy was manipulated only in the second picture; she was always in the first picture. In addition, when the competitor was present in the second picture, it was much smaller and hence less salient than the referent. Furthermore, Arnold and Griffin's (2007) task was narrative production for a hypothetical addressee. Research using a referential communication task, where the speaker instructed the addressee to pick

up the referent in the visual context, suggests that speakers avoid ambiguous nouns more often when they believe their addressee can see a referential competitor than when they believe the addressee cannot (Horton & Keysar, 1996; Nadig & Sedivy, 2002). Speakers in Arnold and Griffin might have ignored the visual presence of Daisy, because they may have thought that the hypothetical addressee could not see Daisy or because they had no idea what the addressee's task would be. Finally, the referent was always the subject in the preceding sentence. It is possible that the competitor's visual presence did not affect the referent's saliency, because the referent was highly salient in the linguistic context. When the referent is not a subject and therefore less salient in the linguistic context, visual context may be more likely to have an effect.

Thus, in order to determine whether and under what circumstances visual context affects the choice of referring expression, I conducted two experiments to investigate whether the choice of referring expression is determined by the referent's linguistic saliency only or whether referential choice is also affected by other, non-linguistic factors that affect saliency, such as visual context—that is, whether speakers use both linguistic and visual information. In both experiments, I investigated whether the choice of a pronoun or repeated noun phrase to refer to an entity (the referent) was affected by whether the visual context included another entity (hereafter competitor). Experiment 1 investigated whether the presence or absence of a competitor affected referential choice even in the presence of a linguistic context. In this experiment, the competitor had the same gender as the referent, resulting in ambiguity when speakers used a pronoun. Experiment 2 investigated whether the visual context effect in Experiment 1 was due to ambiguity

avoidance, by contrasting the effects of visual context when the competitor had either the same or a different gender from that of the referent.

Experiment 1

I examined whether, even in the presence of a linguistic context, the visual presence of a competitor resulted in fewer pronouns for the referent. Both entities had the same gender, and so pronouns were ambiguous. Participants first saw a picture (Figure 5), where the referent (e.g., a pirate) was either (a) together with the competitor (e.g., a prince) or (b) without the competitor. At the same time, the participant read aloud a context sentence, which either mentioned (2) or did not mention (3) the competitor:

Competitor mentioned

2. The pirate's carpet had been cleaned by a prince.

Competitor not mentioned

3. The pirate's carpet had been cleaned.

In order to ensure that the linguistic saliency of the referent was not so high that it would mask any effects of visual context and to ensure that participants did not always produce pronouns, the referent was a possessive modifier of the subject (rather than the subject itself). Next, a second picture appeared below the first, and the participant described the action of the referent toy character (the pirate) to the confederate, who acted out the description. As in the first picture, the competitor was either (a) present or (b) absent.

a: Competitor present b: Competitor absent

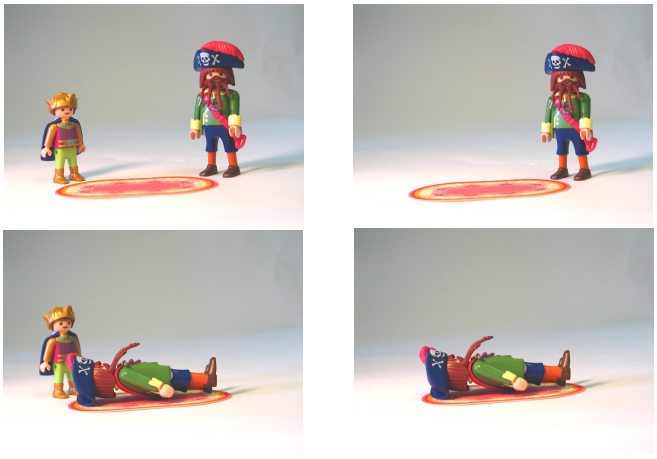

Figure 5. *Example pictures in the competitor-present and the competitor-absent conditions in Experiment 1*

I examined whether participants used a pronoun or a repeated definite noun phrase to refer to the pirate. If the linguistic mention of the competitor affects the choice of referring expression, then participants should use fewer pronouns (relative to repeated noun phrases) to refer to the pirate when the prince was mentioned than otherwise. Most interesting, if the visual presence of the competitor has a similar effect, then participants may also use fewer pronouns when the prince is visually present than otherwise.

Method

Participants. A total of 24 students from the University of Dundee who were native speakers of British English (aged 18–30 years) took part in return for payment or course credit. None of them reported to be dyslexic.

Materials. I constructed 24 experimental item sets. Each version of an item consisted of two photographs of miniature toy characters (such as a king, a queen, a pirate, or a mermaid) and a context sentence (see Appendix 1). Figure 5 illustrates an example photograph set. In the figure, (a) represents the competitor present condition, in which the referent (the pirate) and the competitor (the prince) were visually present, whereas (b) represents the competitor-absent condition, in which only the pirate was present. Both versions included an additional object (e.g., a carpet). The bottom half of each panel depicted a simple action by the referent using the object (e.g., lying on the carpet). The competitor character did not engage in any action. The positions of the referent and the competitor characters were counterbalanced between items.

The linguistic mention of the competitor was varied in the context sentence. The referent character (e.g., the pirate) was always the first-mentioned noun phrase and the possessive modifier of the subject, and it had a definite article. In the competitor-mentioned condition (2), the competitor (e.g., the prince) was the last-mentioned noun phrase, occupying the role of the agent in the by-phrase passive sentence, and it had an indefinite article. In the competitor-not-mentioned condition, the by-phrase was removed from the full passive sentence used for the competitor-mentioned condition. The gender of the competitor character was the same as that of the referent. The object (the carpet) was mentioned after the referent character in both conditions. Sentences were in the pluperfect and in the passive voice. The sentence structure was chosen on the basis of pilot experiments, which showed that participants had no strong preference for pronouns rather than repeated noun phrases when referring to the referent.

There were 14 male and 10 female toy characters, each appearing in two items, once as the referent and once as the competitor. The nouns describing the characters were usually gender unambiguous (see Appendix 1), and in cases where they were not, the appearance of the characters was a clear indicator of their gender (e.g., a bearded gardener).

In addition, four practice items and 29 filler items were constructed. They were presented in the same way as the experimental items. The number of characters appearing in the photographs or mentioned in the context sentence for these items was varied. Specifically, the fillers included the following: 10 items with two human characters (seven with different genders, three with the same gender) that were both visually present and mentioned (in these fillers, the second-mentioned character was the agent of the action depicted in the second pictures, so that unlike the experimental items, the first-mentioned character was not the target referent); 12 items with one human character that was linguistically introduced and visually present (three of these items contained an additional human character linguistically introduced but visually absent); and seven items that included animal characters (in four of these, the animal characters were the agent).

Design. In the context sentence, the competitor was either mentioned or not mentioned. In the pictures, the competitor was either visually present or absent. This resulted in a 2 (linguistic context: competitor mentioned vs. not mentioned) × 2 (visual context: competitor present vs. absent) within-participants and within-items design. Together with the 29 filler items, the 24 sets of experimental items were distributed across four lists, each containing one version of each item and six experimental items from each condition. A total of six participants were randomly

assigned to each list. The items of each list were presented in a fixed quasi-random order, with the constraint that the same character did not appear in consecutive items.

Procedure. Before the experiment, both the participant and the confederate were told that the experiment was about how people communicate verbally when they cannot see each other. The experimenter treated the confederate as a genuine participant throughout, and a post-experimental questionnaire showed no evidence that participants realised that the confederate was not a participant. The participant and the confederate drew lots to determine who was the speaker and the addressee, but the experimenter ensured that the participant always got the speaker role. Next, the experimenter explained the tasks in detail, and four practice trials followed before the experiment started.

During the experiment, the participant and the confederate sat side by side at a table, each facing a computer screen, and the experimenter sat behind them. A board between the participant and the confederate prevented them from seeing each other. Visual stimuli (a context sentence and the two photographs) were presented on the screens using DMDX software (Forster & Forster, 2003). Each participant's speech was recorded on a MiniDisc, which was later used for coding. At the beginning of each trial, both the participant and the confederate saw a photograph of miniature toy characters on their screen. The confederate received the toys from the experimenter to recreate the visual scene depicted in the photograph on the table such that the participant sitting on the other side of the board could also see the toys. To ensure that the participant was aware of what was on the table, the participant checked whether the scene on the table matched the one on the computer screen before pressing a computer mouse key to proceed. A context sentence then appeared below the first photograph on the participant's computer screen (the confederate did

not see this sentence or the following photograph). The participant read aloud the context sentence and pressed a key. The sentence was then replaced by a second photograph appearing below the first picture. The participant described the photograph to the confederate, who acted out the description using the toys. When participants produced a pronoun in the presence of two characters, the confederate always used the referent character for the action, but except for this, the confederate always followed the participant's description literally. The experiment took around 45 minutes.

Scoring. I scored whether participants produced a pronoun or a repeated noun phrase in cases where they referred to the referent character as the subject in the first sentence they produced. I excluded 21 trials where participants did not refer to the referent character as the subject, including two cases where participants mistakenly referred to the competitor. I also excluded seven trials where participants used a different noun phrase instead of a repeated noun phrase (such as the boy rather than the prince), including one trial where a stewardess was referred to as a captain (a noun phrase with a different gender bias) and two trials where the stewardess was referred to with a pronoun with the wrong gender. In total, 30 trials (5% of all responses) were excluded.

Results

Figure 6 presents the percentages of pronouns out of all pronoun and repeated noun phrase responses by condition. Throughout this thesis, I will report two analyses of variance (ANOVAs) conducted on arcsine-transformed proportions of pronoun responses (Winer, 1971) (see Appendix 2 for the exact formula), one on the

participant means (*F*1) and one on the item means (*F*2). In addition to ANOVAs, I also conducted additional analyses using logit mixed-effects models for all experiments in this thesis. Logit mixed-effects models are designed for binomially distributed data (Jaeger, 2008). ANOVAs and logit mixed-effects models did not produce different results that would have affected the interpretation of the data in any experiments in my thesis. Thus, throughout this thesis, I will report only ANOVAs in the text, while the results from mixed-effects models are reported in the Appendix. The ANOVAs included linguistic context (competitor mentioned vs. competitor not mentioned) and visual context (competitor present vs. competitor absent) as within-participants and within-items variables and participant/ item list (I–IV) as a between-participants and between-items variable in order to remove variability due to differences between the lists (Pollatsek & Well, 1995).

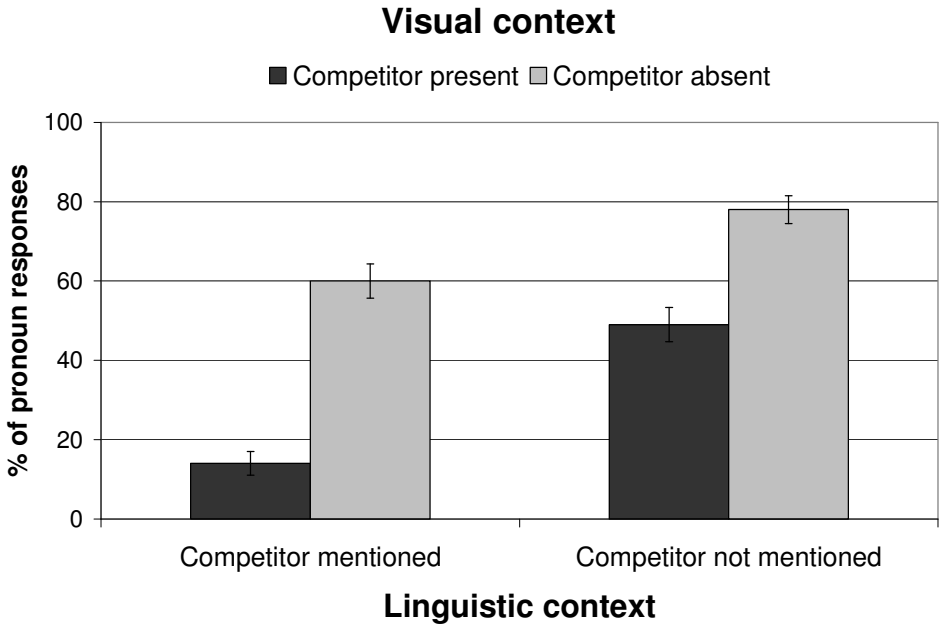

Figure 6. *Percentages of pronouns out of all pronouns and repeated NPs by linguistic and visual context (Experiment 1). Bars represent standard errors.*

First, there was a main effect of visual context, with fewer pronoun responses when the competitor was visually present (31%) than when it was absent (69%), $F1(1, 20) = 51.17$, $p < .001$, $\eta_p^2 = .719$; $F2(1, 20) = 227.77$, $p < .001$, $\eta_p^2 = .919$. Second, there was a main effect of linguistic context: Participants produced fewer pronouns when the competitor was mentioned (37%) than when it was not mentioned (63%), $F1(1, 20) = 55.81$, $p < .001$, $\eta_p^2 = .736$; $F2(1, 20) = 44.63$, $p < .001$, $\eta_p^2 = .691$. The interaction between linguistic and visual context was marginally significant by participants and significant by items, $F1(1, 20) = 3.37$, $p = .081$, $\eta_p^2 = .144$; $F2(1, 20) = 6.33$, $p = .021$, $\eta_p^2 = .240$, suggesting that the effect of competitor presence was larger when the competitor was mentioned (46%) than when it was not (29%). Importantly, the simple effect of visual context was significant in both linguistic contexts: Planned comparisons using two separate one-way ANOVAs showed that the presence of the competitor resulted in fewer pronoun responses in both the competitor mentioned condition, $F1(1, 20) = 40.05$, $p < .001$, $\eta_p^2 = .667$; $F2(1, 20) = 202.11$, $p < .001$, $\eta_p^2 = .910$, and in the competitor-not-mentioned condition, $F1(1, 20) = 22.98$, $p < .001$, $\eta_p^2 = .535$; $F2(1, 20) = 36.06$, $p < .001$, $\eta_p^2 = .643$. See Appendix 3 for the results from logit mixed-effects modelling.

Discussion

Experiment 1 examined whether speakers used visual context when referring to an entity that had already been linguistically introduced into the discourse. The results provided clear evidence that they did: Participants produced 38% fewer pronouns when the competitor was visually present than otherwise. The effect of visual context was found both when the competitor was linguistically introduced and when

it was not. That is, even when the competitor was not linguistically introduced, its visual presence reduced pronoun use. This suggested that the competitor can become part of the discourse representation even though it has not been linguistically mentioned. In addition, participants produced 26% fewer pronouns when the competitor had been mentioned than otherwise. This is similar to the effect of linguistic competitor observed by Arnold and Griffin (2007), where the presence of a linguistic competitor was manipulated by either including a prepositional phase mentioning the competitor (e.g., with Daisy) or not. In the current experiment, the competitor was part of a passive *by*-phrase, indicating that the linguistic competitor effect occurs across different structures.

Thus, both linguistic mention and visual presence of the competitor led to fewer pronouns. Interestingly, the effects of linguistic and visual context were not independent: The visual context effect was somewhat larger when the competitor was mentioned than when it was not, as indicated by the near-significant interaction between visual and linguistic context. This suggests that when the competitor was not mentioned, the referent was highly salient in the linguistic context, so whether or not the competitor was present in the visual context played a smaller role in determining whether to choose a pronoun or a repeated noun phrase. But when the competitor was mentioned, the linguistic saliency of the referent and competitor differed less, so the competitor's visual presence had a greater impact. This finding suggests that speakers took into account linguistic and non-linguistic information simultaneously when choosing a referring expression.

Experiment 2

The results of Experiment 1 showed that the visual presence of a same-gender competitor results in fewer pronouns to refer to an entity introduced in the immediately preceding sentence, indicating that speakers use visual context even when there is a preceding linguistic context. One possibility is that effects of a same-gender competitor are due to ambiguity avoidance. Research has shown that speakers use fewer pronouns when the linguistic context includes a competitor that has the same gender as the referent (Arnold, Eisenband, Brown-Schmidt, & Trueswell, 2000; Arnold & Griffin, 2007) than when it does not contain a same-gender competitor. In a similar way, speakers may avoid pronouns when the visual context contains a competitor with the same gender. In Experiment 1, when the same-gender competitor was visually present, a pronoun could refer to either the referent or the competitor in the visual context and was therefore ambiguous. In contrast, when the competitor was absent, there was only one entity in the visual context that could be referred to by the pronoun. Therefore, the effects may not generalise to cases where the presence of a competitor does not affect the ambiguity of the pronoun.

Alternatively, it is possible that the visual context effect in Experiment 1 was not due to ambiguity avoidance, but occurred because the visual presence of the competitor made the referent less accessible, and this reduction in accessibility occurred regardless of ambiguity. Arnold and Griffin (2007) argued that the presence of a competitor in the prior linguistic context reduces the accessibility of the referent, because it competes for attentional resources with the referent. Similarly, the presence of a competitor in the visual context may also reduce the accessibility of the referent, and, therefore, participants may use more explicit referring expressions in

the competitor-present than in the competitor-absent condition, even when there is no ambiguity. Hence, visual presence of the competitor should result in fewer pronouns even if the competitor has a different gender from that of the referent.

Of course, the visual context effect in Experiment 1 may have been due to a combination of the referent's saliency and ambiguity avoidance. Experiment 2 therefore contrasted the effects of competitor presence when the use of a pronoun was ambiguous versus when it was unambiguous, using context sentences such as (4) and (5):

Same gender (pronoun ambiguous)

4. The pirate's carpet had been cleaned by a prince.

Different gender (pronoun unambiguous)

5. The pirate's carpet had been cleaned by a princess.

Following the context in (4), the use of a pronoun to refer to the pirate is ambiguous, because the competitor (the prince) has the same gender as the referent, whereas following (5), a pronoun is unambiguous because the referent and competitor (the princess) have a different gender. If the effect of visual context in Experiment 1 is entirely due to ambiguity avoidance, participants should produce fewer pronouns for the pirate when the prince is present than when he is absent in the visual context, but the presence of the princess should not affect how participants refer to the pirate. In contrast, if the effect of visual context occurs because the visual presence of the competitor reduces the accessibility of the referent, the visual presence of the competitor (the princess) should have an effect even if it has a different gender from the referent. Finally, if the visual context effect is both due to

the reduction in the referent's accessibility and due to ambiguity avoidance, we should observe an effect of the competitor's visual presence in both gender conditions, but the visual context effect should be larger in the same gender than in the different gender condition, resulting in an interaction between visual context and the competitor's gender.

1: Same gender (ambiguous) **2: Different gender (unambiguous)**

a: Competitor present b: Competitor absent a: Competitor present b: Competitor absent

Figure 7. *Example pictures in the same gender and different gender conditions for both the competitor-present and -absent conditions (Experiment 2)*

Method

Participants. A total of 24 further students from the same population as that in Experiment 1 took part for payment or course credit. Data from one additional participant, who guessed that the confederate was not a genuine participant, were replaced by data from another participant.

Materials. As in Experiment 1, there were 24 experimental item sets in four versions, each comprising a pair of photographs and a context sentence. Figure 7 illustrates an example photograph set for one item: In the figure, (1a) and (1b)

represent the same gender conditions, in which the referent (the pirate) and the competitor (the prince) have the same gender, whereas (2a) and (2b) represent the different gender conditions, in which the referent and the competitor (the princess) have a different gender. In both gender conditions, the competitor was either present (a) or absent (b). In the context sentence, the competitor was always mentioned, but the gender of the competitor was manipulated, as in Sentences (4) and (5).

For both gender conditions, I paired 12 male and 12 female competitors with similar character roles (see Appendix 1). The competitor character always had a gender-unambiguous character name (e.g., the king, the queen), so the gender of each competitor character was linguistically marked. For the referent character, I selected 14 male and 10 female character roles whose gender had never been misunderstood in Experiment 1 (the stewardess character, whose gender was misunderstood by two participants in Experiment 1, was replaced by a more feminine-looking stewardess), so that there was no confusion about the gender of the characters. The actions depicted in the second picture were identical to those in Experiment 1, except one action (falling off the chair), which was replaced because participants often did not refer to the referent as the subject of the first sentence in their target descriptions.

As in Experiment 1, there were four practice items and 29 filler items. Unlike Experiment 1, the competitor in the experimental items was always mentioned in the context sentence, so it seemed possible that the overall likelihood of pronoun use might be lower in the current experiment. Therefore, four out of the 11 filler items from Experiment 1 in which two characters were both visually present and mentioned were replaced by items in which only a single character was visually present and mentioned.

Design. The referent and competitor had either the same or a different gender, and the competitor was either present or absent in the visual context. In addition, the experiment was divided into two halves and I manipulated the order in which the two blocks were presented. This was done to explore the possibility that the effects of ambiguity changed over time. For instance, as the experiment progresses, participants may become aware that the use of a pronoun is ambiguous in the same gender condition but not in the different gender condition, resulting in a change in their sensitivity to the gender manipulation between the first and the second half of the experiment (cf. Snedeker & Trueswell, 2003). Thus, a 2 (ambiguity: same gender vs. different gender) × 2 (visual context: competitor present vs. absent) × 2 (experiment half: first vs. second half) mixed design was used, resulting in eight item lists. Together with the 29 filler items, the 24 experimental items were distributed across the eight lists, each list having three experimental items in each condition, with one version of each item. The items of each list were presented in a fixed quasi-random order, subject to the constraint that the same character should not occur consecutively. A total of three participants were randomly assigned to each list.

Procedure. This was the same as that in Experiment 1.

Scoring. The responses were scored in the same way as in Experiment 1. I excluded six trials on which participants did not refer to the referent as the subject of their first target sentence, six trials on which participants used noun phrases other than a repeated noun phrase (e.g., the child rather than the girl), and one trial on which the participant produced a pronoun with the wrong gender (due to misreading the context sentence). In total, 13 trials (2% of all responses) were excluded.

Results

Figure 8 presents the percentages of pronouns out of all pronoun and repeated noun phrase responses by condition. Analyses of variance on the arcsine transformed proportions of pronoun responses out of all pronoun and repeated noun phrase responses were conducted, with ambiguity and visual context as within-participants and within-items variables and participant/ item list (I–VIII) as a between-participants and between-items variable. There was no main effect of experiment half nor did it interact with any other variable, so I collapsed across this variable.

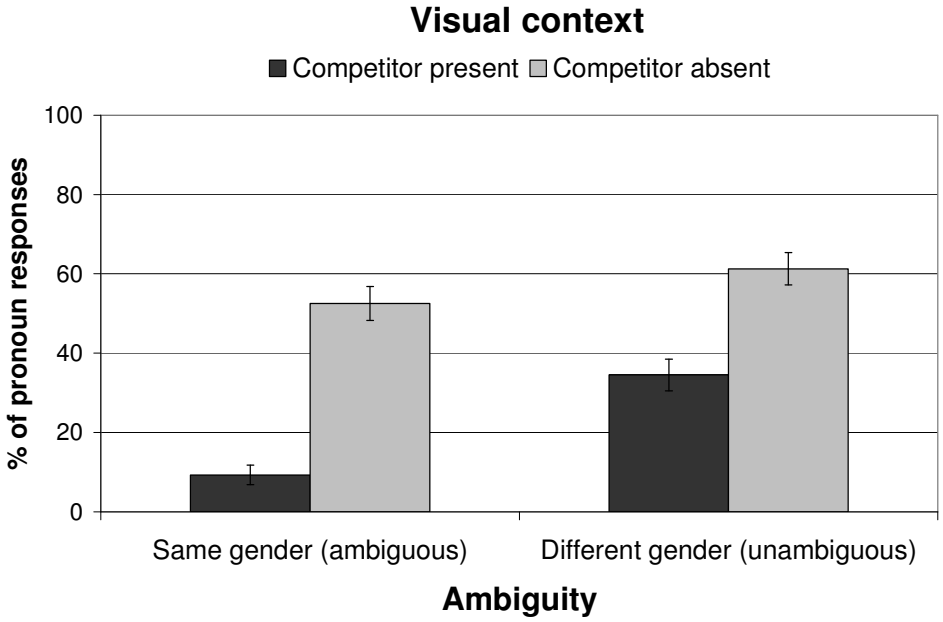

Figure 8. *Percentages of pronouns out of all pronouns and repeated NPs by visual context and ambiguity* (*Experiment 2). Bars represent standard errors.*

The ANOVAs revealed a main effect of visual context: Participants produced fewer pronouns when the competitor was present (22%) than when it was not (57%), $F1(1, 16) = 44.42$, $p < .001$, $\eta_p^2 = .726$; $F2(1, 16) = 170.16$, $p < .001$, $\eta_p^2 = .914$.

There was also a main effect of ambiguity, with fewer pronoun responses when the gender of the two characters was the same (31%) than when it was different (48%), $F1(1, 16) = 17.48$, $p = .001$, $\eta_p^2 = .522$; $F2(1, 16) = 48.11$, $p < .001$, $\eta_p^2 = .750$. In addition, there was a significant interaction between ambiguity and visual context, $F1(1, 16) = 6.83$, $p = .019$, $\eta_p^2 = .299$; $F2(1, 16) = 9.90$, $p = .006$, $\eta_p^2 = .382$, indicating that the visual context effect was larger in the same gender condition, when a pronoun was ambiguous (43%), than in the different gender condition, when it was unambiguous (27%).

Importantly, however, planned comparisons using two separate one-way ANOVAs showed that the effect of visual context was significant in both the different gender conditions, $F1(1, 16) = 16.23$, $p = .001$, $\eta_p^2 = .504$; $F2(1, 16) = 56.01$, $p < .001$, $\eta_p^2 = .778$, and the same gender conditions, $F1(1, 16) = 62.11$, $p < .001$, $\eta_p^2 = .795$; $F2(1, 16) = 148.78$, $p < .001$, $\eta_p^2 = .903$. In other words, participants produced fewer pronouns in the competitor-present than in the competitor-absent condition, both when pronouns were unambiguous and when pronouns were ambiguous. See Appendix 3 for the results from logit mixed-effects modelling.

Discussion

The results from Experiment 2 showed that participants used 27% fewer pronouns for the referent character when the visual context contained a competitor character of a different gender than when there was no competitor in the visual context. Because pronouns were not ambiguous in either visual context, the effect in the different gender conditions cannot be due to ambiguity avoidance. Rather, the results from

these conditions suggest that the visual context effect occurred because the visual presence of the competitor reduced the accessibility of the referent, resulting in fewer pronouns when the competitor was visually present than when it was absent.

However, ambiguity avoidance contributed to the visual context effect: The visual context effect was larger in the same-gender than in the different-gender conditions, as indicated by the interaction between visual context and ambiguity. In the different-gender conditions, pronouns were always unambiguous, because they could only refer to the referent, regardless of whether the competitor was present in the visual context. In contrast, in the same-gender conditions, pronouns were always ambiguous, but the presence of the competitor in the visual context affected the *interpretability* of the pronoun. When the competitor was present, the visual context contained two entities that the pronoun could refer to, but when the competitor was absent, the visual context contained only one entity to which the pronoun could refer, so pronouns may have been seen as sufficiently interpretable in the competitor absent conditions. As a result, the visual context effect was larger in the same gender than in the different-gender conditions.

Furthermore, the fact that visual context and ambiguity interactively affected the choice of referring expressions indicated that the effect of visual context on choice of referring expression in Experiment 1 did not simply occur because the presence of a visual competitor increased the visual complexity of the referential context. Instead, the effects appear to be at least partly driven by whether the pronoun's gender allowed reference to the competitor.

General Discussion

Experiment 1 showed that even in the presence of a linguistic context, visual context affects the choice of referring expression: Participants used fewer pronouns when a same-gender competitor was present than when it was absent in the visual context. The effect of visual context was significant even when the competitor was not linguistically introduced, but the effect was smaller than when the competitor was linguistically introduced. Experiment 2 showed that the effect of visual context was not limited to cases where the use of a pronoun was ambiguous. Even when the competitor had a different gender from the referent (so pronouns were unambiguous), the competitor's visual presence resulted in fewer pronouns, suggesting that the visual presence of a different-gender competitor reduced the accessibility of the referent. In addition, visual context and ambiguity of the pronoun interacted, indicating that speakers avoided gender ambiguous pronouns more often when the competitor was present than when it was absent in the visual context.

The current results differ from Arnold and Griffin (2007) in that I found an effect of visual competitor, whereas they did not. As discussed in the Introduction, I ascribe the difference to three main factors. First, the visual manipulation in Arnold and Griffin was much weaker than the one used in the current study. In their study, the visual presence of the competitor was varied only in the second picture; the competitor character was always present in the first picture, whereas in the current study, it was varied in both pictures. In addition, when the competitor was present, its size in the second picture was much smaller than the size of the referent. Second, the referent was the subject in the linguistic context in Arnold and Griffin, whereas in the current experiments it was not. The referent's high linguistic saliency may

have weakened the effect of visual context in their experiment. Third, participants in Arnold and Griffin's study were asked to describe the pictures as if telling stories to a hypothetical addressee, whereas in the current study, participants were asked to describe the pictures when the addressee had to act out the description by using real objects. As discussed earlier, the presence of a referential competitor appears to play a stronger role in ambiguity avoidance in a referential communication task if the addressee also sees the competitor than otherwise (Horton & Keysar, 1996; Nadig & Sedivy, 2002). I suggested that the presence of a different gender competitor did not significantly influence the use of pronouns in Arnold and Griffin's study, not only because it was unclear whether the visual context should be taken as shared or privileged information, but also because there was no clear task for the addressee in their experiment.

Whether and to what extent each of these variables contributed to the patterns of results we found are questions for future investigation. For example, it is plausible that the impact of a visual context varies depending on the referent's saliency in the prior linguistic context, because it is consistent with the finding from Experiment 1 that the effect of a visual competitor is smaller when the competitor is not mentioned in the linguistic context than when it is: The more salient the referent is in the linguistic context, the weaker the impact of its visual saliency is.

We might also wonder whether there was any strategic component with respect to the effects of visual competitor we found. Because the addressee had to manipulate the objects in the real world in the current experiment, speakers may have adopted a task-specific strategy to minimize ambiguity for their addressee. It is possible that the presence of an acting-out task might have heightened speakers' sensitivity to the visual competitor. However, such task-oriented reference occurs

commonly in daily conversations—whether it is to ask someone to pick up the table salt or to direct a car driver to get to the right destination—and is presumably more natural or representative of most language use than is speaking to a hypothetical addressee (e.g., Clark, 1996). In the current study, participants knew that real communication was taking place, and I suspect that this was the main reason why they made considerable effort to be clear and paid particular attention to the presence of a competitor in the referential context. In other words, in situations where speakers are less concerned about the communicative consequences of their choice of referring expression (for example, they assume that the addressee does not have to identify their intended referent), they may be less attentive to the presence of a referential competitor.

The finding that the visual context affected the choice of referring expressions even when there was a prior linguistic context and even when the use of a pronoun was unambiguous supports the idea that linguistic and non-linguistic factors together determine the referent's salience in the discourse and speakers' choice of referring expression. Speakers used pronouns more frequently and definite noun phrases less frequently when the referent was more salient in the visual context. This is similar to the way linguistic salience affects the choice of referring expression: Experiment 1 and several other studies (Arnold, 2001; Arnold & Griffin, 2007; Fletcher, 1984; Fukumura & Van Gompel, 2010; Stevenson et al., 1994) have shown that language producers use more pronouns and fewer explicit referring expressions when the referent is salient in the linguistic context than when it is not. Thus, although current theories of referential choice often do not explicitly consider the role of visual context, they can straightforwardly be extended to account for visual effects.

Previous research has suggested that language producers use pronouns for linguistically salient referents because pronouns are more reduced than definite noun phrases and hence signal that the referent is highly prominent in the linguistic context (e.g., Brennan, 1995; Gordon et al., 1993; Grosz, et al., 1995). Perhaps, for the same reasons, speakers also prefer pronouns over definite noun phrases when the referent is highly salient in the visual context (i.e., when there was no visual competitor in the current experiments). Using fuller referring expressions such as definite noun phrases for a referent that is highly salient in either the linguistic or visual context may lead the addressee astray because they signal that the referent is less accessible (Ariel, 1990; Givón, 1983a; Gordon & Chan, 1995; Gordon et al., 1993) or provide unnecessary semantic information that slows down processing (Almor, 1999). In contrast, if the referent is not salient in the linguistic context, speakers tend to use definite noun phrases. It has been argued that this is done to provide richer semantic information that facilitates the identification of the referent (e.g., Almor, 1999; Chafe, 1994; Grice, 1975) and bring the referent into the centre of attention (Brennan, 1995). The effects of visual context can be explained in a similar way: Speakers use definite noun phrases when the referent is not very salient in the visual context (i.e., when it is a visual competitor) in order to facilitate its identification.

However, while this interpretation fits very well with current theories of reference, whether speakers choose referring expressions to signal the referent's accessibility to the addressee requires further scrutiny. Chapter 6 therefore addressed this issue by manipulating the referent's accessibility to the speaker independently from the referent's accessibility to the addressee.

In sum, the current study has demonstrated that speakers use both linguistic and visual, non-linguistic saliency when choosing referring expressions in discourse. First, the visual presence of a competitor makes the referent less accessible, which leads to the reduction in pronoun usage. Second, visual saliency affects ambiguity avoidance: Speakers are more likely to avoid ambiguous pronouns when a same-gender competitor is present than when it is absent in the visual context. These findings indicate that speakers use both linguistic and non-linguistic information in a way that facilitates effective communication.

Affordances

Introduction

Although the production of referring expressions is usually fast and fluent, the processes involved can be complex. One of the complexities results from the fact that speakers can use different referring expressions. For instance, a definite noun phrase such as *the king* provides semantically rich information about the referent, whereas a pronoun such as *he* provides little information about the referent. When referring, speakers need to make a choice amongst the alternatives. Another complexity arises from the fact that the referential context often includes other, competing entities that could be interpreted as the referent, which may cause referential ambiguity. Chapter 4 explores the possible mechanisms that underpin the choice of referring expressions when the context contains referential competitors.

One possible mechanism that speakers may use for avoiding referential ambiguity is to consult the referential context to check if referring expressions they are planning to produce makes the referent uniquely identifiable. For example, speakers may decide whether to use the pronoun *he* or the definite noun phrase *the king* by taking into account whether the referential context includes another male character that could be the referent of the pronoun *he*. Indeed, research has shown that speakers are less likely to use a pronoun when the gender of the pronoun is consistent with reference to a competitor (because it has the same gender) than when it is not (Arnold & Griffin, 2007; Fukumura, Van Gompel, & Pickering, 2010, Chapter 3). Similarly, speakers are more likely to use adjectival modifiers (e.g., *the*

big circle rather than *the circle*, Ferreira et al., 2005; Horton & Keysar, 1996; Sedivy, 2003) or to produce subordinate expressions (e.g., *the pennyloafer* rather than *the shoe*, Brennan & Clark, 1996) if the context includes an additional exemplar from the same semantic category.

However, such elaborate assessment of ambiguity may be time consuming, and gets especially complex when there are many potential competitors. Thus, it may not be the kind of strategy speakers normally use during sentence production. Arnold and Griffin (2007) recently suggested that the phenomena that have been taken as evidence for ambiguity avoidance could instead be explained in terms of similarity-based interference. They argued that the effect of gender ambiguity may result from the fact that a same-gender competitor is more similar to the referent than a different-gender competitor. When the competitor is semantically similar to the referent, it causes strong interference, which in turn reduces the accessibility of the referent. That is, the referent may be less accessible in the context of a same gender competitor than in the context of a different gender competitor, which may explain why pronouns are less frequent in the former than in the latter case. In other words, what seems to be a deliberate act of ambiguity avoidance may be due to similarity-based interference affecting the referent's accessibility: The retrieval of the referent's representation gets harder if there are other referential candidates with similar representations in memory, because they make the referent's representation less distinguishable from its referential competitors.

Indeed, many theories of reference assume that the referent's level of accessibility influences the choice of referring expressions; people tend to favour reduced referring expressions such as pronouns when the referent is accessible, while they favour more explicit referring expression such as names or definite noun

phrases when the referent is less accessible (Ariel, 1990; Grosz et al., 1995; Gundel et al., 1993). Research has shown that the referent's accessibility does indeed influence the form of reference. Pronouns are more frequent when the prior linguistic context makes the referent highly accessible because it was recently mentioned (Ariel, 1990; Givón, 1983a), because the referent had a prominent structural position in the preceding sentence (Arnold, 2001; Fletcher, 1984; Fukumura & Van Gompel, 2010; Stevenson et al., 1994), or because there was no referential competitor in the prior linguistic or visual context (Ariel, 1990; Arnold & Griffin, 2007; Clancy, 1980; Fukumura et al., 2010, Chapter 3).

The similarity-based interference account may also explain why speakers tend to avoid ambiguous bare noun phrases when the context contains an examplar from the same category. Ferreira et al. (2005) showed that speakers avoid ambiguous bare nouns less frequently when the referent (e.g., a flying bat) is present in a visual context with a competitor from the same semantic category (e.g., a larger flying bat) than in a context with with a competitor from a different category (e.g., a baseball bat). One possible explanation for this is that a same category competitor is more similar to the referent than a different category competitor. The high similarity between the referent and the competitor makes retrieval of the referent hard, which results in more frequent use of explicit, modified expressions such as *the bigger bat* compared to cases where the competitor has a different semantic category. That is, the referent's low accessibility due to similarity-based interference may the driving force behind the more frequent use of restrictive modifiers.

But it is not clear that similarity between discourse entities affects the choice of referring expressions. The problem is that in gender marking languages, a pronoun is ambiguous when the competitor has the same gender as the referent but

not when the competitor has a different gender, so the effect of gender congruence could be due to ambiguity avoidance rather than semantic interference. Similarly, when the referential context contains a referential competitor from the same semantic category, using a bare noun is ambiguous, so the use of a restrictive modifier can straightforwardly be explained as ambiguity avoidance, that is, speakers avoid expressions that could also refer to the competitor. In short, it is unclear if similarity-based interference affects the choice of referring expressions.

To test the similarity-based interference account, we need to examine situations where similarity is manipulated independently from the factors that affect the ambiguity of the expression. I did this by examining whether congruence between the referent's and competitor's action-based affordances affect the choice of pronouns and repeated noun phrases. Recent research suggests that interference occurs during non-linguistic tasks in cases where two objects have the same affordances. Ellis, Tucker, Symes, and Vainio (2007) showed that response times for grabbing a target object are affected by whether a competitor object is compatible with the specific grabbing action. They showed that the execution of a target action was slower when a competitor in the visual context was compatible with that action than when it was not, suggesting that the competitor's action-compatibility interfered with the execution of the target action. Furthermore, research on language comprehension by Chambers, Tanenhaus, and Magnuson (2004; see also Chambers, Tanenhaus, Eberhard, Filip, & Carlson, 2002) has shown that the action-compatibility of the referential competitor plays an important role in how addressees interpret ambiguous instructions. When listening to temporarily ambiguous instructions such as *Pour the egg in the bowl over the flour* in the visual context of two broken eggs, addressees tended to interpret *in the bowl* as the modifier of *the egg*,

but when the visual context contained only one broken egg and one solid egg, they initially considered *in the bowl* as the goal of the target action rather than a modifier of the noun phrase. This finding suggests that when the context contains two action-compatible eggs, the addressee tends to expect additional disambiguating information, whereas when the context contains only one action-compatible egg, they do not, even though the noun phrase *the egg* could refer to either the solid or the broken egg.

The critical question I address in the current study is whether interference due to congruence in the action-based affordances of the referent and a referential competitor affects the choice between a pronoun and a repeated noun phrase independently from ambiguity avoidance and if so, what the mechanism behind the effect is. If a competitor can carry out the same action as the referent, does this result in more explicit referring expressions than when the competitor does not afford this action? For example, when describing an entity getting off a horse, do speakers experience interference when a competitor can also get off a horse (because it is sitting on one) compared to when it is not sitting on a horse? One possibility is that congruence in affordances affects the choice of referring expression because the competitor's similarity to the referent reduces the referent's accessibility. As a result, pronouns (relative to repeated noun phrases) should be less frequent when the competitor can also get off a horse than otherwise, regardless of whether the use of a pronoun is ambiguous (when the referent and competitor have the same gender) or not (when they have a different gender).

Alternatively, congruence in affordances may not have an effect on the referent's accessibility, but speakers may instead use affordances during ambiguity avoidance. That is, speakers may consider the competitor's affordances to

disambiguate an otherwise ambiguous referring expression. If the referent (a king) and the competitor (a pilot) are both male and sitting on a horse, then the utterance *He gets off the horse* can be interpreted as referring to the referent as well as the competitor. However, if the male competitor is not on a horse, the competitor cannot be interpreted as the referent of the utterance because, although the pronoun is consistent with his gender, the action that follows the pronoun is not consistent with his affordances (not sitting on a horse). In such situations, speakers may not avoid gender-ambiguous pronouns as frequently as when the competitor is also on a horse. In contrast, when the competitor is female (a stewardess), *He gets off the horse* cannot refer to the competitor even when the competitor is on a horse, because the gender of the pronoun rules out reference to the competitor. Therefore, if speakers use affordances during ambiguity avoidance, affordance congruence should only have an effect when the pronoun is ambiguous.

Recent research by Brown-Schmidt and Tanenhaus (2008) has suggested that this may be the case. In one of their experiments, they examined how speakers used restrictive modifiers when they instructed their addressee to arrange blocks on a board during unscripted task-based conversations. They observed that speakers were more explicit when a competitor block shared a task-relevant property (e.g., its position relative to other blocks made it a plausible referential candidate) than when it did not. However, importantly, such an effect only occurred with competitors that made the referring expression ambiguous (e.g., a horizontal competitor block made reference to a horizontal target block ambiguous); when the competitor did not make the referring expression ambiguous (e.g., when the competitor was a vertical block), the explicitness of the referring expression was unaffected by whether the competitor was relevant to the task. The results therefore seem to suggest that the task constraint

affects ambiguity avoidance such that speakers produce more explicit, disambiguating referring expressions when the task relevance of the competitor does not rule out reference to the competitor. However, in Brown-Schmidt and Tanenhaus's study, speakers received feedback from their addressees. It is therefore possible that over the course of the experiment, speakers became aware of the fact that they had to provide disambiguating information when the competitor shared a task-relevant property, whereas they did not have to do this when it did not share such a property. Furthermore, because the conversations were unscripted, the preceding exchange was not controlled, so there may be other factors that explain the difference.

The current study investigated whether the choice of referring expressions is affected by similarity-based interference in conditions where the preceding linguistic context is controlled and speakers did not receive feedback. Experiment 1 investigated if congruence in action-based affordances between the referent and the competitor affected the choice of pronouns and definite noun phrases both when the pronoun was gender-ambiguous and gender-unambiguous. To anticipate the results, our participants produced fewer pronouns when the competitor afforded the same action as the referent than when it did not, and this affordance congruence effect was equally large when the competitor had a different gender from the referent as when it had the same gender, supporting the similarity-based interference account rather than the ambiguity avoidance account. Experiment 2 further demonstrated that the effect of affordances found in Experiment 1 was partly the result of perceptual similarity between the entities. Pronouns were less frequent when the competitor was in the same situation as the referent than in the different situation, even though in both conditions, the competitor always afforded the target action. However, the effect of

situation was larger when similarity constrained the competitor's compatibility with the to-be-described action of the referent, suggesting that interference is strongest when the competitor is activated as the possible agent of the to-be-described action.

Experiment 1

To examine if the choice of pronouns and definite noun phrases is affected by congruence in affordances - whether a competitor can carry out the same action as the referent - I used a referential communication task in which a speaker (a participant) described actions carried out by toy characters to his/her addressee (a confederate). On each trial, participants read aloud a context sentence (1a-b) appearing below a picture (e.g., the top panels of Figure 9), before describing a second picture which was subsequently presented underneath the first picture (one of the bottom panels in Figure 9). The second picture showed an action carried out by the first-mentioned character (the *referent*) in (1) and was invisible to the addressee, who had to act out the description using the toys placed on a table. I scored whether participants used a pronoun or repeated noun phrase when referring to the referent (e.g., *He/The king got off the horse*).

1a. The king visited the castle with the pilot.

1b. The king visited the castle with the stewardess.

I manipulated the affordances of the last-mentioned character (the *competitor*, e.g., the pilot/stewardess) in Sentence (1a-b), such that in the top picture panel, the competitor either afforded the action depicted in the bottom panel (getting

off a horse) because it was in the same situation as the referent (i.e., both on a horse, 1a and 2a) or it did not afford the same action because it was in a different situation (i.e., only the referent, the king, is on a horse, 1b and 2b). I also varied the gender of the competitor, which had either the same (pilot, 1) or a different gender (stewardess, 2) from the referent; the use of pronoun was ambiguous in the same gender condition, but unambiguous in the different gender condition. If congruence in affordances results in interference and therefore reduces the referent's accessibility, speakers should use fewer pronouns (therefore, more repeated NPs) in the same situation condition, where both the referent and competitor can carry out the target action, than in the different situation condition, where only the referent affords the action, and importantly, we should observe this effect in both the same gender and the different gender condition. If speakers use affordances only as a disambiguating cue, the effect of affordances should be found only when pronouns are gender ambiguous.

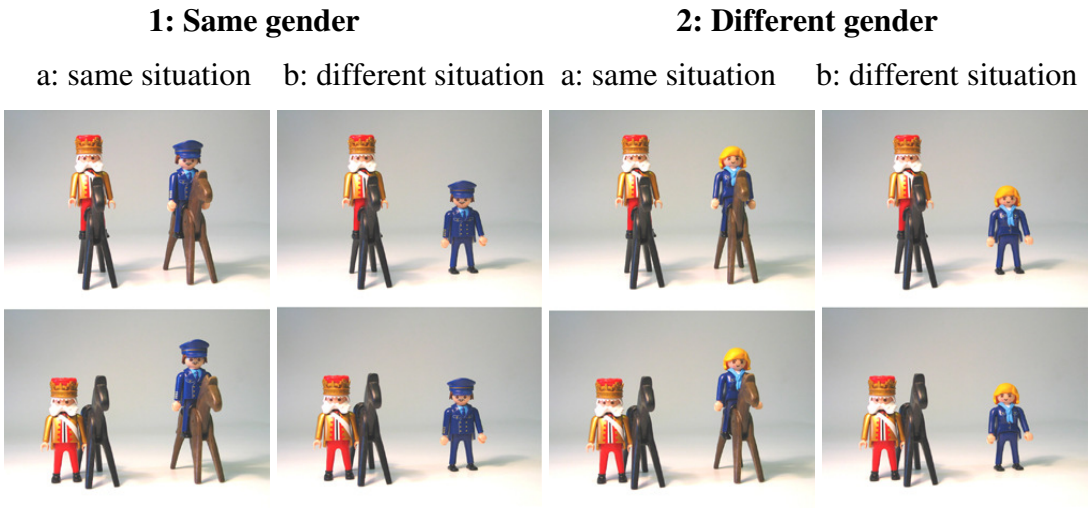

Figure 9. *Example pictures in the same and different situation conditions for both the same and different gender conditions (Experiment 1).*

Method

Participants. Thirty-two undergraduate students of the University of Dundee took part. They were all reported to be native speakers of British English (aged 18-30), non-dyslexic, and had normal or corrected-to-normal vision. Data from three additional participants were collected but were excluded from further analyses due to not producing neither pronoun nor repeated noun phrase in more than 25% of all the trials (by mainly using many verb co-ordinations such as "*And then got off.*").

Materials. I constructed 24 experimental item sets. Each item involved two colour photographs of miniature toy characters (see Figure 9) and a context sentence (1). In the figures, (1a-b) represent the *same gender* conditions, where the referent (the king) and the competitor (the pilot) had the same gender, whereas (2a-b) represent the *different gender* condition, where the referent and the competitor (the stewardess) had a different gender. In both conditions, the characters were either in the *same situation* (1a & 2a) (e.g., both are on the horse) or *different situation* (1b & 2b), (e.g., the king is on the horse but the pilot/stewardess is standing). Importantly, in the same situation conditions (1a & 2a), the competitor afforded the action carried out by the referent depicted in the bottom half of each panel (e.g., getting off the horse), whereas in the different situation condition, it did not (1b & 2b). The positions of the referent and the competitor characters were counterbalanced between items.

The characters were introduced in a context sentence with a definite article (1), but the sentence did not provide information about the competitor's affordances. The referent (the king) was always mentioned in the subject position and the competitor (the pilot/stewardess) in the prepositional *with* phrase. The past tense was used throughout (see Appendix 4). In addition, I constructed four practice items and

31 filler items. The filler items included the following: 15 fillers with only one entity present in the visual context (four out of these had an additional character that was linguistically introduced but that was visually absent); 16 filler items with two entities that were linguistically introduced and were present in the visual context (four out of these fillers had animal(s) as the agent of the target action).

Procedure. Before the experiment, both the participant and the confederate were told that the experiment was about how people communicate verbally when they cannot see each other. The experimenter treated the confederate as a genuine participant throughout, and a post-experimental questionnaire showed no evidence that participants realised that the confederate was not a participant. The participant and the confederate drew lots to determine who was the speaker and the listener, but the experimenter ensured that the participant always got the speaker role. Next, they sat side-by-side at a table, each facing a computer screen, and a board between them prevented them from seeing each other. The experimenter explained the tasks, and the practice trials followed before the experiment started.

On each trial, both the participant and the confederate first saw a photograph of miniature toy characters on their screen. The confederate received the toys from the experimenter and laid them out on the table to recreate the visual scene depicted in the photograph. The participant then pressed a computer mouse key to proceed, which triggered a presentation of a context sentence below the first photo on its computer screen (the confederate did not see this sentence or the following photo). The participant then had to read aloud the context sentence and press a key. The sentence was then replaced by a second photo appearing below the first picture. The participant described the photo to the confederate, who acted out the description using the toys. When participants produced a pronoun in the presence of two

characters, the confederate always picked up the referent for the action but acted out the exact action as described by the participant. The participant indicated whether the action corresponded to the one in the photograph by pressing the yes or no button. Each session took around 45 minutes including a short break half-way through. I counterbalanced the order in which the first and the second halves of the experiment were presented between participants.

Design. The characters had either the same or different gender and they were either in the same or different situation. This resulted in a 2 (ambiguity: same gender vs. different gender) x 2 (situation: same situation vs. different situation) within-participants and within-items design. I thus used four lists, where the 24 experimental and 31 filler items were distributed in a fixed quasi-random order, with the constraint that the same character should not appear in consecutive items. Each list had six experimental items in each of the four ambiguity x situation conditions, with one version of each item occurring in each list. Eight participants were randomly assigned to each list.

Scoring. I scored whether participants produced a pronoun or a repeated noun phrase in cases where they referred to the referent as the subject in the first clause of the new sentence they produced. I excluded cases where participants referred to both characters (e.g., *They both began to walk.*) (N = 6), the subject was dropped ("*And then got off.*") (N = 14), participants changed their initial choice of referring expressions from a pronoun to a repeated noun phrase (e.g., "*He…the gladiator dropped his sword*") (N = 10), they mistakenly used the competitor's role name ("*…the prince…the admiral got out of the stand.*") (N = 3), a participant used a non-repeated noun phrase (e.g., "*the knight*" instead of "*the gladiator*") (N = 4), a participant referred to a competitor first ("*The mermaid made her laugh so she fell*

off the bench.") (N = 1) and participants referred to the objects (e.g., "*The fire-extinguisher's upside down.*") (N = 6). In total, 44 trials (6% of total responses) were excluded from analyses.

Results

Figure 10 presents the percentages of pronouns out of all pronoun and repeated noun phrase responses by condition.

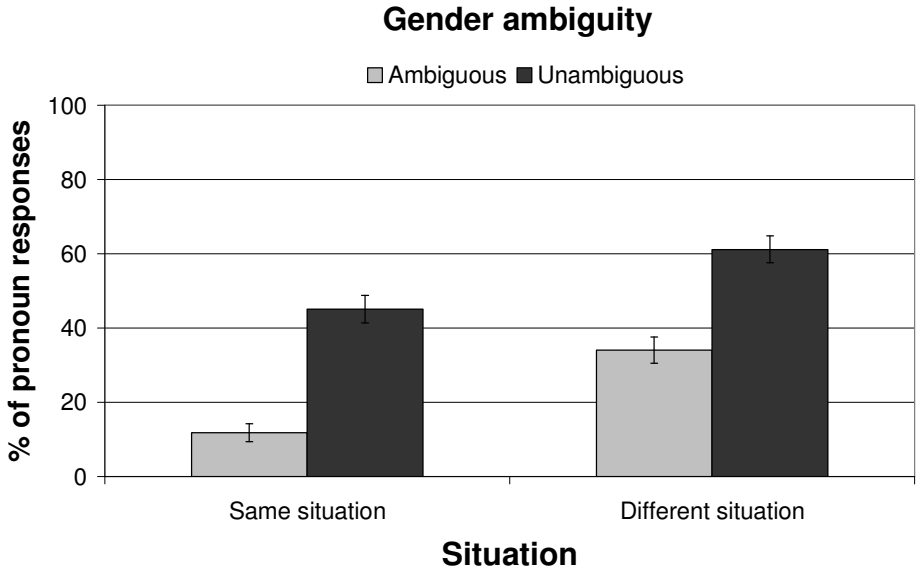

Figure 10. *Percentages of pronouns out of all pronouns and repeated NPs by situation and ambiguity (Experiment 1). Bars represent standard errors.*

Analyses of variance were performed on the arcsine- transformed proportions by including gender ambiguity and situational context as within-participants and -items variables and participant/item list (I-IV) as a between-participants and -items variable. Analyses showed a main effect of situation, $F1(1, 24) = 37.23$, $p < .001$, $\eta_p^2 = .608$; $F2(1, 16) = 70.14$, $p < .001$, $\eta_p^2 = .814$, suggesting that participants used significantly fewer pronouns (relative to repeated noun phrases) in the same situation

(28%) than in the different situation condition (48%). In addition, pronouns were less frequent in the same gender condition (23%) than in the different gender condition (53%), $F1(1, 24) = 64.79$, $p < .001$, $\eta_p^2 = .730$; $F2(1, 16) = 94.20$, $p < .001$, $\eta_p^2 = .855$. The effect of situation was not significantly modulated by gender ambiguity, $F1(1, 24) = 3.16$, $p = .088$, $\eta_p^2 = .116$; $F2(1, 16) = 1.82$, $p = .196$, $\eta_p^2 = .102$, though the pattern of means suggested that the effect of gender ambiguity was slightly stronger in the same situation condition (33%) than in the different situation condition (27%). Crucially, the effect of situation was significant in the both ambiguous condition, $F1(1, 16) = 18.99$, $p < .001$, $\eta_p^2 = .543$; $F2(1, 16) = 19.99$, $p < .001$, $\eta_p^2 = .555$ and unambiguous condition, $F1(1, 16) = 7.28$, $p = .016$, $\eta_p^2 = .313$; $F2(1, 16) = 6.91$, $p = .018$, $\eta_p^2 = .302$.

Table 4. *Percentages of repairs from a pronoun to a repeated NP (Experiment 1)*

	Same situation	Different situation
Same gender	5 (10)	0 (0)
Different gender	0 (0)	0 (0)

Note. Numbers in parentheses represent the number of cases.

There were the trials (N = 10) in which speakers changed their referring expression in a repair. All repairs were cases where speakers initially produced a pronoun and then changed to a repeated noun phrase (e.g., *He…the gladiator drives away.)*. Nine participants produced these errors across eight items. Inspection of Table 4 shows that all these cases were observed in one condition, where a pronoun was gender ambiguous and the competitor afforded the target action, which might suggest that during later stages of production, speakers corrected gender ambiguous pronouns to

a noun phrase if the competitor afforded the target action but they did not if the competitor did not. However, the numbers were considered too low to allow a meaningful analysis. ANOVAs with these additional cases coded as pronouns showed no interaction between gender ambiguity and situational context on pronoun usage, *F*s <1, suggesting that the effect of situational context did not depend on whether the competitor had the same gender as the referent (18%) or not (16%). See Appendix 5 for the results from logit mixed-effects modelling.

Discussion

Consistent with previous studies (Arnold & Griffin, 2007; Fukumura et al., 2010, Chapter 3), participants produced fewer pronouns in the same rather than different gender condition, suggesting that speakers avoided gender ambiguous pronouns. More importantly, they produced pronouns less often and repeated noun phrases more frequently when the competitor afforded the target action than otherwise, even when pronouns were unambiguous. This suggests that when the referent and the competitor had the same affordances, interference occurred, making the referent less accessible. Thus, the results provide the first clear evidence that similarity affects the choice of referring expressions independently from ambiguity avoidance. The finding that the effect of affordances did not interact with the gender ambiguity of the pronoun suggests that speakers did not use affordances for ambiguity avoidance. One possibility is that assessing the ambiguity of a particular expression with respect to the affordances of the competitor may be resource-demanding, because speakers have to combine multiple sources of information, that is, whether the competitor has the same gender as the referent and whether it affords the same action as the referent.

Experiment 2

Experiment 1 showed that speakers reduce pronoun use when the competitor affords the same action as the referent regardless of whether the gender of the competitor makes pronouns ambiguous, suggesting that similarity-based interference occurs when the referential context includes a competitor that is compatible with the action that is predicated of the referent. Experiment 2 investigated two possible mechanisms of how interference may arise. One possibility is that interference occurs because when speakers conceptualise an action, all entities that can be the agent of the action become activated. If the competitor affords the target action, the context contains two possible agents in the speaker's message representation, which causes interference when speakers access the referent's representation. Alternatively, interference may occur regardless of whether the competitor affords the to-be-described action. That is, when the referent and competitor are both sitting on a horse, they are perceptually similar, and this perceptual similarity causes interference, making it harder for speakers to access the referent's representation during conceptualisation. This should result in interference not just when the speaker intends to say *gets off the horse*, but also when s/he plans to produce *takes off his hat*.

Experiment 2 therefore varied whether the similarity manipulation (e.g., both referent and competitor on a horse or only the referent on a horse) was related to the action mentioned in the target description. Given that the effect of affordances was not modulated by the gender of the competitor, Experiment 2 only investigated cases where the competitor always had the same gender as the referent. Figure 11 presents example stimuli. In the *related action* conditions (3a-b), the to-be-described

action (getting off a horse) is related to the similarity manipulation (whether the competitor is on the horse or not), as in Experiment 1. In contrast, in the *unrelated action* conditions (4c-d), the target action (taking off a hat) is unrelated to the similarity manipulation: In both the same and different situation conditions, the competitor afforded the target action.

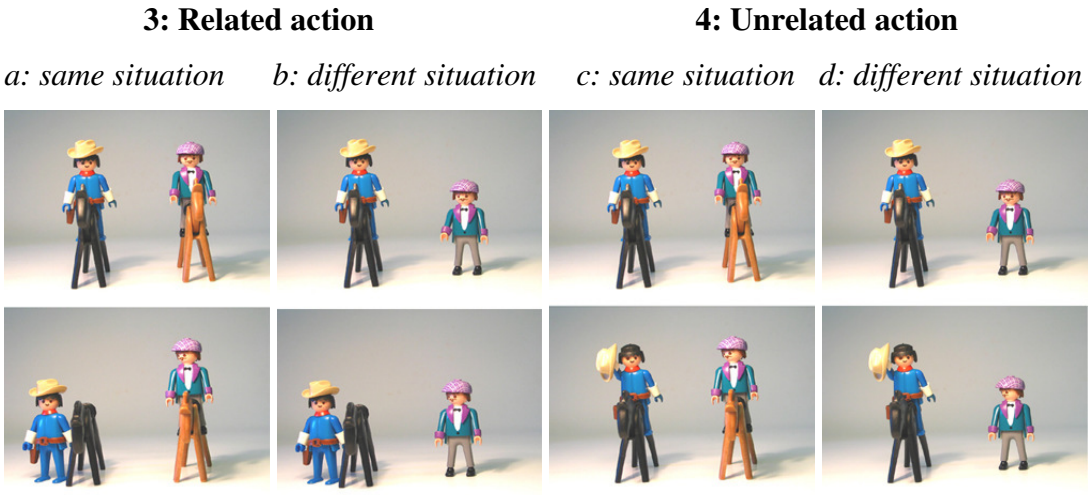

Figure 11. *Example pictures in the same and different situation conditions for both the related and unrelated action conditions (Experiment 2).*

If the competitor's compatibility with the to-be-described action causes interference, we should observe an effect of situation in the related action conditions. When speakers plan to produce *gets off the horse*, this should activate the competitor as a possible referent in the same situation condition, but not in the different situation condition. As a result, in the related action conditions, we should observe fewer pronouns and more repeated noun phrases in the same than the different situation condition. However, in the unrelated action conditions, the competitor affords the target action (*takes off his hat*) in the same as well as in the different situation

conditions, so the proportion of pronoun responses should be the same in both situation conditions.

In contrast, if interference is independent of the to-be described action, the competitor in the same situation condition should interfere with reference production regardless of whether the competitor can carry out the target action. In both related and unrelated action conditions, the similarity of the referent and competitor is higher in the same situation than in the different situation. Therefore, speakers should produce fewer pronouns and more repeated noun phrases in the same situation than in the different situation conditions. Finally, it is possible that similarity-based interference occurs both when the competitor affords to-be-described action and when it does not, but interference is stronger when the target utterance describes an action that is consistent with both the referent and competitor. This predicts an effect of situation in both the related and unrelated action conditions, but the effect should be stronger in the related action conditions.

Method

Participants. Thirty-two new participants from the same population took part. Data from additional two participants, who produced neither pronoun nor repeated noun phrase in more than 25% of all the trials were collected but were excluded from further analyses. (These participants mainly produced many verb co-ordinations.)

Materials. As in Experiment 1, 24 sets of experimental items were constructed. In Figure 11, (3a-b) represent the *related action* conditions, where in the *same situation* condition (3a), the competitor afforded the target action (getting off a horse), whereas in the *different situation* condition (3b), it did not. In contrast, (4c-d)

represent the *unrelated action* conditions, where the competitor afforded the target action (taking off a hat) in both *same* (4c) or *different situation* (4d) conditions. The structure of the context sentence was the same as in Experiment 1, except that the competitor always had the same gender as the referent.

Each item had a related and unrelated action pair. In total, I used 17 different related actions (seven actions were repeated over two different items), all of which were taken from Experiment 1, except that one action (falling off a chair), which had produced many invalid responses (because participants often referred to the non-target objects), was replaced by a new action (holding the brush in both hands). I created nine different unrelated actions, such as taking off the hat, putting both hands up, turning around, and bending over (six actions were repeated over two different items and three over four different items) (see Appendix 4 for details). I used 12 male and 10 female referent characters (two characters were repeated over two items), each of which was combined with a competitor of the same gender. Filler items were the same as in Experiment 1, except that I changed some characters in the two-character filler items so that the use of a pronoun was unambiguous.

Design. The characters were either in the same or different situation, and the competitor's affordance of the target action was either related or unrelated to the situational similarity between the characters. Thus, I used a 2 (situation: same vs. different) x 2 (action type: related vs. unrelated) within-participants and within-items design, resulting in four lists. The items were distributed in a quasi-random order, with the constraint that the same character should not appear in consecutive items. I also distributed the items such that if the same action was used in two items, participants were assigned to the conditions such that they saw the action only once. For instance, *turning around* was repeated over two items in the unrelated action

condition. I distributed the conditions such that a participant who saw this action in one item did not see this action again in another item. I also ensured that actions that were repeated over four different items, participants did not see the action more than twice. Eight participants were randomly assigned to each list.

Procedure and scoring. These were the same as in Experiment 1. In total, I excluded 42 trials (5% of total responses) from analyses because participants referred to the objects (N = 8) or the competitor (N = 5) rather than the referent; they did not produce new sentences (e.g., "…..*when she dropped her candles*") (N = 3) or omitted the subject ("*And got off the table.*") (N = 5); other noun phrases instead of repeated noun phrases (e.g., *the king* instead of *the prince*) (N = 4); the competitor's role name was used by mistake (N = 2); participants repaired their choice of referring expressions ("*She, the woman sat down.*") (N = 15).

Results

Figure 12 presents the percentages of pronoun responses. The analyses were conducted in the same way as in Experiment 1, except that situation and action type were included as within-participants and -items variables. Pronouns were less frequent in the same situation (13%) than in the different situation (27%), resulting in a main effect of situation, $F1(1, 24) = 24.88$, $p < .001$, $\eta_p^2 = .509$; $F2(1, 16) = 36.97$, $p < .001$, $\eta_p^2 = .698$. There was no main effect of action, $F1(1, 24) = 1.79$, $p = .194$, $\eta_p^2 = .069$; $F2(1, 16) = 1.02$, $p = .328$, $\eta_p^2 = .060$. Importantly, however, there was a significant interaction between situation and action, $F1(1, 24) = 7.30$, $p = .014$, $\eta_p^2 = .233$; $F2(1, 16) = 9.88$, $p = .006$, $\eta_p^2 = .382$. The effect of situation was larger in the related action condition (21%), where the similarity manipulation determined whether the competitor could carry out the to-be-described action, than in the

unrelated action condition (8%), where the similarity manipulation was unrelated to the affordances of the competitor. Interestingly, the effect of situation was significant not only in the related action, $F1(1, 24) = 20.45$, $p < .001$, $\eta_p^2 = .460$; $F2(1, 16) = 57.49$, $p < .001$, $\eta_p^2 = .782$, but also in the unrelated action conditions, $F1(1, 24) = 7.05$, $p = .014$, $\eta_p^2 = .227$; $F2(1, 16) = 6.73$, $p = .020$, $\eta_p^2 = .296$. The situation effect in the unrelated action conditions suggests that similarity between the referent and competitor caused interference even when the utterance was unrelated to the similarity manipulation.

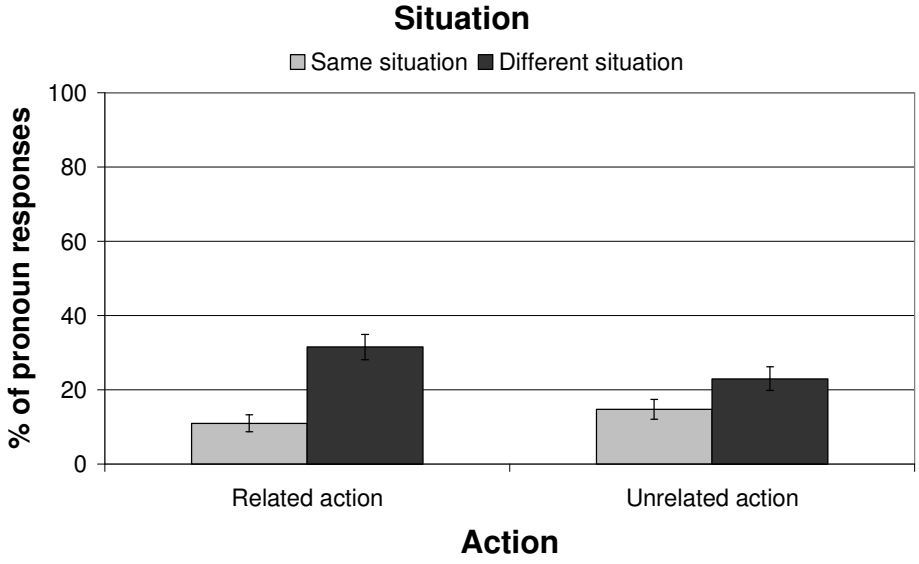

Figure 12. *Percentages of pronouns out of all pronouns and repeated NPs by situation and action type (Experiment 2). Bars represent standard errors.*

As in Experiment 1, there were cases (N = 15) where participants changed their initial choice of a pronoun to a repeated noun phrase. Ten participants produced these errors across 11 items. Inspection of Table 5 suggests that neither action nor situation alone affected these repairs, but they appeared to interact. In the related action conditions, the proportion of repairs was higher in the same than the different

situation condition, whereas in the unrelated action conditions, the difference was less clear and if anything, errors were more frequent in the different than in the same situation condition. However, these numbers were again considered too low to allow further analyses.

Table 5. *Percentages of repairs from a pronoun to a repeated NP (Experiment 2)*

	Same situation	Different situation
Related action	3.1 (6)	0 (0)
Unrelated action	1.0 (2)	3.7 (7)

Note. Numbers in parentheses represent the number of cases.

I also examined how participants' initial choice of referring expressions was affected by the competitor's affordances and situational congruence. After including these repairs as pronouns, which were the form of expression participants produced initially, in ANOVAs, the interaction between situation and action was slightly weakened, $F1(1, 24) = 3.67$, $p = .067$, $\eta_p^2 = .133$; $F2(1, 26) = 4.35$, $p = .053$, $\eta_p^2 = .214$, though the effect was very close to significance, with a larger effect of situation in the related action condition (18%) than the unrelated action condition (10%). In contrast, the simple effect of situation remained robust in both the related action condition, $F1(1, 24) = 18.51$, $p < .001$, $\eta_p^2 = .435$; $F2(1, 16) = 61.75$, $p < .001$, $\eta_p^2 = .794$, and in the unrelated action condition, $F1(1, 24) = 6.84$, $p = .015$, $\eta_p^2 = .222$; $F2(1, 16) = 7.21$, $p = .016$, $\eta_p^2 = .311$, with fewer pronouns in the same situation (16%) than in the different situation (26%). See Appendix 5 for the results from logit mixed-effects modelling.

Discussion

The results showed that similarity-based interference arises in two ways. First, similarity between the referent and competitor affected the choice of referring expression even when the to-be-described action (*taking off one's hat*) was unrelated to the similarity manipulation. This suggests that similarity between the referent and competitor causes interference and reduces the referent's accessibility even when the described action is incompatible with the competitor. Second, the similarity-based interference effect was stronger when the target utterance described an action that *was* compatible with the competitor. This is consistent with the idea speakers activate all entities that can be the agent of the to-be-described target action and that this causes additional interference when the referent and competitor are similar.

Observations of repairs suggested that there were more repairs when the competitor was in the same than a different situation if the target utterance described an action related to the similarity manipulation. Although statistical significance of this difference could not be established, it is consistent with the idea that the additional interference due to the competitor's compatibility with the target action at least partly occurs during later production processes. In contrast, situational similarity did not significantly influence the likelihood of repairs when the target utterance was unrelated to the similarity manipulation, which suggests that the similarity manipulation may not affect later processing to the same degree. Therefore, additional interference when the utterance is consistent with the competitor's affordances may occur later than the interference that is independent of the to-be-produced utterance.

General Discussion

The current study investigated whether similarity-based interference affects the choice of referring expressions. Experiment 1 showed that speakers produced fewer pronouns (and therefore more repeated noun phrases) when the competitor was in the same situation as the referent and afforded the target action carried out by the referent than otherwise, regardless of whether the use of a pronoun was gender ambiguous or unambiguous. Because an effect of situation similarity was found both when pronouns were ambiguous and unambiguous, these findings cannot be due to ambiguity avoidance. Instead, they support the idea that a competitor with a similar situational representation as the referent reduced the referent's accessibility and hence the frequency of pronoun use. Experiment 2 showed that participants produced pronouns less frequently when the competitor was in the same situation as the referent than otherwise even when the competitor did not afford the to-be-described action. The results thus suggested that the competitor's perceptual similarity to the referent causes interference irrespective of what message speakers intend to convey about the referent, presumably because the presence of a similar competitor in memory interferes with the identification of the memory representation of the referent. However, the effect of situation was larger when the similarity manipulation was related to the competitor's affordances of the target action, indicating that additional interference occurs when the competitor is activated as a possible agent of the action that that the speaker wants to describe.

Thus, the results provide evidence that interference due to similarity between discourse entities affects the choice of referring expression. Because similarity was manipulated in terms of non-linguistic properties, the locus of the

interference should be placed at the level of non-linguistic, preverbal conceptual representations. One possibility is that a competitor with similar non-linguistic properties made the referent's conceptual representation less accessible. When the referent's conceptual representation is less accessible, speakers reactivate more semantic information about the referent, compared to when it is accessible. Therefore, speakers are less likely to produce semantically impoverished referring expressions such as pronouns when the referent's conceptual representation is less accessible than when it is accessible. That is, the explicitness of referring expression is affected by the degree of conceptual reactivation speakers had to engage in when retrieving the referent's representation from memory.

Although the results indicate that the affordance effects we observed were not the result of ambiguity avoidance, we may wonder if the gender congruency effect found in Experiment 1 was due to ambiguity avoidance or because, as suggested by Arnold and Griffin (2007), the presence of a same-gender competitor causes semantic interference. This is very hard to determine, because in English, pronouns are always ambiguous in the same gender condition but not in the different gender condition. My recent finding, however, suggests that even in a non-gender marking language such as Finnish, speakers tend to produce pronouns less frequently when the competitor has the same gender as the referent than when it has a different gender from the referent, though the effect was smaller compared to English. Thus, the gender congruency effect in English may be at least partly affected by semantic interference.

The results of Experiment 1 showed that the competitor's affordances affect pronoun usage whether or not the gender of the pronoun rules out reference to the competitor. In other words, speakers avoided gender ambiguous pronouns equally

frequently, regardless of whether the affordances of the competitor ruled out reference to it. One possibility is that evaluating the ambiguity of a pronoun in relation to the competitor's affordances during language production is cognitively too costly, because it would require speakers to keep the to-be-produced expression in memory while they evaluate the ease of its interpretation, which would take away cognitive resources that could be used for other aspects of language production (Ferreira et al., 2005). Indeed, in Experiment 1, there were cases (N = 10), where speakers replaced a pronoun with a repeated noun phrase (nine participants produced these repairs across eight items). Such repairs were only found in conditions where pronouns were gender ambiguous and when the context did not provide disambiguating cues, suggesting that although speakers ultimately evaluated the ambiguity of the pronoun in relation to the competitor's affordances, evaluating the felicity of the to-be-produced referring expression against the specific referential context is not the kind of activity that occurs in normal utterance planning.

That said, I do not rule out the possibility that speakers may use their knowledge about the competitor's affordances during ambiguity avoidance when they know it is necessary. For instance, because the interest of our current study was to investigate whether speakers take into account the physical constraints of the referential context in their "one-shot" utterances, I controlled for the addressee's feedback by using an experimental confederate, who was instructed to pick up the target even when speakers produced globally ambiguous utterances. It is possible that a naïve addressee might have asked for clarification in response to the globally ambiguous utterances, which may have provided an opportunity for speakers to learn the needs of their addressee (Horton & Gerrig, 2002). Indeed, Brown-Schmidt and Tanenhaus (2008) found that speakers took into account the task-relevance of the

competitor only when there is no disambiguating cue available, but in their study, the addressee was allowed to freely interact with the speaker, so the speaker may have learned from the addressee's feedback when to avoid ambiguous referring expression. That is, if speakers learnt that a gender ambiguous pronoun is especially hard to interpret when the competitor affords the target action, they might engage in cognitively costly monitoring to evaluate the expressions against the referential context before producing them.

In sum, Chapter 4 has shown that the competitor's similarity to the referent's non-linguistic representation affects the choice of referring expressions: Speakers produced fewer pronouns (and therefore more repeated noun phrases) when the competitor was similar to the referent than when it was not. The finding was observed regardless of whether pronouns were ambiguous and unambiguous, suggesting that similarity in affordances of the referent and competitor resulted in interference. Furthermore, interference was affected by the competitor's perceptual similarity to the referent as well as its compatibility with the message that was being produced.

Addressee's discourse model

Introduction

One of the most controversial issues in recent language production research is to what extent speakers model the needs of their addressee when choosing particular linguistic forms (Allbritton et al., 1996; Bard & Aylett, 2005; Ferreira & Dell, 2000; Horton & Keysar, 1996; Kraljic & Brennan, 2005; Schafer et al., 2000; Snedeker & Trueswell, 2003). Clearly, for communication to succeed, speakers must produce utterances that are comprehensible for their addressee. In his seminal work on conversational maxims, Grice (1975) argued that speakers should tailor their utterances so that they are maximally helpful by providing as much information as necessary for their addressee to avoid ambiguity but not being overly informative. That is, speakers must be cooperative, not egocentric, by designing utterances that are easy for their addressee (the audience design hypothesis). The view that language production is a cooperative process was further elaborated by Clark and his colleagues, who argued that speakers achieve audience design by constructing the model of the addressee and by constantly updating it (e.g., Clark, 1996; Clark & Carlson, 1982; Clark & Marshall, 1981; Clark & Murphy, 1982). However, the extent to which the model of the addressee influences speakers' linguistic performance has been under constant debate (e.g., Dell & Brown, 1991; Horton & Gerrig, 2005a, 2005b; Horton & Keysar, 1996; Pickering & Garrod, 2004). Some of the linguistic phenomena that have been ascribed to audience design have been explained in terms of production-internal constraints that favour speech that is easy

to produce (e.g., Brown & Dell, 1987; Pickering & Garrod, 2004). Chapter 5 investigates whether speakers use the addressee's discourse model when choosing the form of reference.

Most previous studies have approached the issue of audience design by investigating the role of perspective-taking when speakers avoid ambiguous referring expressions. For instance, studies have found that when speakers are not under time pressure, they tend to avoid ambiguous bare noun phrases (e.g., *the circle*) more frequently when a referential competitor of the same semantic category (another circle) is visible to their addressee than when it is not (e.g., Horton & Keysar, 1996; Nadig & Sedivy, 2002), indicating that speakers use the addressee's visual perspective when avoiding referential ambiguity. In line with this, Matthews, Lieven, Theakston, and Tomasello (2006) found that even children as young as 3 and 4 years old take into account whether the addressee can see the referent when using pronouns that have no linguistic antecedent in the immediate context (using *unheralded pronouns*, Gerrig, 1986). Other studies have found that speakers tend to avoid expressions that may be unfamiliar to the addressee because they are based on conceptualizations formed with a different addressee (Brennan & Clark, 1996; Horton & Gerrig, 2002, 2005b; Wilkes-Gibbs & Clark, 1992) or because they require expert-knowledge that is not shared with the addressee (Isaacs & Clark, 1987).

All these studies focused on cases where taking the perspective of the addressee was essential for avoiding ambiguity or potential referential failure. Speakers may take into account the addressee's visual perspective in the studies by Horton and Keysar (1996) and Nadig and Sedivy (2002), because using a bare noun phrase (e.g., *the circle*) is ambiguous when the addressee can see a referential

competitor of the same category (another circle). Similarly, unheralded pronouns do not identify the referent when the referent is invisible to their addressee (Matthews et al., 2006) and speakers may take into account the addressee's familiarity with the referent or referring expression because they know that otherwise their addressee cannot uniquely identify the referent (e.g., Isaacs & Clark, 1992; Horton & Gerrig, 2002; 2005b; Wilkes-Gibbs & Clark, 1992).

However, according to many theories of reference (Ariel, 1990; Chafe, 1974, 1994; Clark & Marshall, 1981; Givón, 1983a, 1992; Grosz et al., 1995; Gundel et al., 1993; Marslen-Wilson et al., 1982; Prince, 1985), audience design is not specific to cases of avoiding ambiguity or potential referential failure, but affects the choice of referring expressions more generally. The general assumption of these theories is that speakers choose particular forms of reference depending on how accessible or salient the referent is for the addressee. That is, speakers choose less explicit referring expressions such as pronouns when they assume the referent is highly salient in the addressee's discourse model, whereas more explicit referring expressions such as names or definite noun phrases are favoured when they assume that the referent is less salient in the addressee's model. For instance, Chafe (1976) argued that "Given (or old) information is that knowledge which the speaker assumes to be in the consciousness of the addressee at the time of the utterance. So-called new information is what the speaker assumes he is introducing into the addressee's consciousness by what he says" (p. 30), so a pronoun is used when speakers assume that the referent is "in the addressee's consciousness" (p. 31). These theories commonly assume that speakers use the form of reference as a processing signal to their addressee (e.g., Ariel, 1990; Chafe, 1974; Givón, 1983a, 1992; Grosz et al., 1995; Gundel et al., 1993; Prince, 1985). By using less explicit referring

expressions, speakers signal that the referent is highly accessible in the addressee's model, whereas by using more explicit referring expressions they signal that speakers should retrieve an entity that is less accessible in their addressee's model. Thus, Givón (1992) argued that speakers use referring expressions "to accommodate the hearer's perspective" and "to *ground* the information into the hearer's perspective." (p. 8) and Ariel (2001) claims that "referring expressions instruct the addressee to retrieve a certain piece of given information from his memory by indicating to him how accessible this piece of information is to him at the current stage of discourse" (p. 29).

Perhaps surprisingly, however, there has been very little evidence that speakers choose referring expressions based on the accessibility or salience of the referent in the addressee's discourse model (rather than their own). Previous studies have shown that reduced referring expressions such as pronouns (relative to more explicit referring expressions such as names or definite noun phrases) are more frequent when the referent is more recently mentioned in the prior discourse (Ariel, 1990; Givón, 1983a). Other studies have found that the antecedent's structural position in the preceding sentence (e.g., Arnold, 2001; Fletcher, 1984; Fukumura & Van Gompel, 2010; Stevenson et al., 1994), the animacy of the referent (Fukumura & Van Gompel, in press, Chapter 6), the presence of a referential competitor in the preceding linguistic context (Arnold & Griffin, 2007) and in the visual context (Fukumura, et al., 2010, Chapter 3) have an effect. However, these findings may be due to the referent's accessibility in the language user's own model rather than in the addressee's model; that is, speakers may be more likely to use pronouns rather than names or definite noun phrases when the referent is highly accessible in their own discourse model rather than in their addressee's model. Keeping track of what is

shared with the addressee may pose a high demand on processing resources (Horton & Keysar, 1996), so speakers may instead base their choice of referring expression on the accessibility of the referent in their own discourse model.

Thus, I conducted two experiments to investigate whether the use of anaphoric expressions is affected by the model of the addressee or whether speakers use their own model. Using a referential communication task, the experiments examined speakers' choice of pronouns and repeated noun phrases when the immediately preceding sentence was either shared with the addressee or privileged to the speaker. In each trial, a speaker and an addressee sat side-by-side at a table and saw a picture such as the top panel of Figure 13 on their own computer screen. The addressee recreated the scene in the photograph on the table, using real toy characters. The speaker then read aloud the first context sentence (1), and subsequently listened to a pre-recorded second sentence (2a-b), which contained a pronoun that referred back to either the last-mentioned character (2a) or the first-mentioned character (2b) in the context sentence (1). The critical manipulation was whether only the speaker could hear the second context sentence (privileged context, presented via headphones to the speaker) or whether the addressee could also hear it (shared context, presented via loudspeakers to both the speaker and the addressee). Finally, the speaker produced the target utterance, describing the picture in the bottom panel of Figure 13 to their addressee. The picture showed an action carried out by the last-mentioned character (the admiral, hereafter *the target*) in the first context sentence (1), and the first-mentioned character (the mermaid, hereafter *the competitor*) did not perform any action. The addressee, who could not see the picture, then had to act out the speaker's description using the toys. I analysed whether the speaker used either a pronoun or repeated noun phrase when producing

the target utterance (e.g., saying *He/The admiral stands up*). The competitor (*the mermaid*) always had a different gender than the target, so reference was unambiguous regardless of whether speakers produced a definite noun phrase or pronoun.

1. The mermaid is waiting for a taxi with the admiral.

2a. He is sitting in a wheelchair.

2b. She is sitting on a bench.

Figure 13. *Example pictures*

Experiment 1

The experiment investigated whether speakers used the addressee's discourse model by testing a pair of participants; one participant took part as the speaker, while the other played the addressee role. There were three conditions in total. In order to avoid possible confusion for the speaker as to whether the addressee heard the critical second context sentence, each condition was tested in a separate block

(counterbalanced for order across the experiment), but the same participant played either the speaker or addressee role in all conditions. In all conditions, the speaker had to refer to last-mentioned character (the target) in the first context sentence (1). The first condition was the *target mentioned - shared condition*. In this condition, the second context sentence referred to the target character (2a) and was presented via loudspeakers, which established a shared context because both the speaker and the addressee heard the sentence. In contrast, in the second condition, the *target mentioned- privileged condition*, the second context sentence (2a) also referred to the target, but it established a privileged context, because it was presented via headphones that the speaker was wearing, so the addressee could not hear the sentence. Finally, in the third condition, the *competitor mentioned- privileged condition*, the second context sentence (2b) was also presented via headphones to the speaker, but it referred to the competitor (*the mermaid*), which had a different gender from the referent.

The referent should be more accessible to the addressee when the addressee heard the reference to the target in the immediately preceding sentence (target mentioned-shared) than when they did not and only the speaker heard the reference to the target (target mentioned-privileged). Thus, if speakers take into account the referent's accessibility in the addressee's model, they should produce more pronouns (therefore, fewer repeated noun phrases) in the target mentioned - shared than the target mentioned - privileged condition. In fact, if speakers completely rely on their addressee's discourse model and ignore privileged information, the percentage of pronouns in the target mentioned - privileged condition should not differ from the competitor mentioned - privileged condition, because in neither condition the addressee heard the second sentence. In contrast, if speakers use their own discourse

model, it should not matter whether the addressee heard the reference to the target in sentence (2a) or not, so the target mentioned - privileged and target mentioned - shared conditions should not differ. However, both conditions should result in more pronouns compared to the competitor mentioned - privileged condition, where immediately preceding sentence (2b) refers to the competitor, which should make the referent less accessible to the speaker.

Method

Participants. Twenty-four pairs of participants from the University of Dundee who were native speakers of British English (aged 17-30) took part in return for payment or course credit. None of them reported to be dyslexic.

Materials. Twenty-four experimental item sets were constructed. Each item set consisted of two photographs of miniature toy characters (such as a king, a queen, a pirate, or a mermaid), a written sentence and an auditory sentence. Figure 13 presents an example photograph panel. The top half of each panel introduced two human characters of different gender (the target and the competitor), and the bottom half depicted a simple action carried out by the target (e.g., standing up from a wheelchair). The positions of the target and competitor characters were counterbalanced between items.

Both the target and the competitor were linguistically introduced in a written sentence, as in (1), where the target (e.g., the admiral) was introduced as the prepositional object in a *with*-phrase and the competitor (e.g., the mermaid) as the subject (see Appendix 6 for details). For each item, two auditory sentences were created. In the target-mentioned condition (2a), the sentence began with a pronoun

referring to the target (the admiral), and in the competitor-mentioned condition (2b), it began with a pronoun referring to the competitor character. In half of the items, the sentence correctly described the picture, whereas in the other half, it did not. The sentence was recorded at normal speaking rate by a female native speaker of British English, sampled at 22 kHz. The mean durations for the referent-mentioned condition (1.62 sec) and the competitor-mentioned condition (1.67 sec) did not differ significantly, $t(23) = 1.30$, $p = .208$. In addition, 12 practice and 36 filler items were constructed.

Procedure and design. Before the experiment, a pair of participants was told that the experiment was about how people communicate verbally when they cannot see each other. They drew lots to determine who was the speaker or the addressee. The speaker and the addressee were then seated side-by-side at a table, facing a computer screen, and a board between them prevented them from seeing each other. The experimenter then explained the tasks orally by presenting the stimuli from the first practice trial. The visual stimuli (the photographs and a context sentence) were presented using DMDX software (Forster & Forster, 2003), and the auditory stimuli were presented via loudspeakers on the table (shared condition) or presented by headphones (privileged condition) that the speaker was wearing. The speaker's speech was recorded on a MiniDisk, which was later used for coding.

At the beginning of each trial, both the speaker and the addressee saw a photograph of miniature toy characters on their screen. The addressee received the toys from the experimenter and recreated the scene depicted in the photograph on the table, so that the speaker sitting on the other side of the board could also see the toys. Once the objects were laid out, the speaker pressed a key to progress, which triggered the presentation of a written sentence, appearing below the first photograph

on the speaker's computer screen (the addressee did not see this sentence or the following photograph). The speaker read aloud the context sentence so that their partner could also hear this sentence, and pressed a key, which prompted the presentation of a pre-recorded auditory sentence (2a-b). In the target mentioned-shared condition, Sentence (2a) was presented via the loudspeakers on the table that participants sat at, and both the speaker and the addressee judged whether the sentence was consistent with the photographs, by pressing a yes or no button. This was done to ensure that the speaker would pay attention to the auditorily presented context sentence. In the target mentioned-privileged-condition and in the competitor mentioned-privileged condition, however, the second sentence was presented via headphones speakers were asked to wear so that the addressee could not hear the sentence. In the target mentioned-privileged-condition, Sentence (2a) and in the competitor mentioned - privileged condition, Sentence (2b) were presented by the headphones, and only the speaker judged whether the sentence matched the picture. Next, a second photograph appeared below the first picture on the speaker's screen, replacing the context sentence. The speaker then described the photograph to the addressee, who was told to act out the description using the toys. To ensure that the speaker paid attention to the addressee's comprehension, the speaker was asked to indicate whether the action corresponded to the one in the photograph by pressing the yes or no button.

Thus, there were three conditions in total: target mentioned-shared, target mentioned-privileged, and competitor mentioned-privileged conditions. The conditions were presented in three separate blocks, and the order of blocks was rotated in six permutations, which comprised six lists, each of which contained 24 experimental items and 36 filler items. Each list had eight experimental items from

each condition, with one version of each item occurring in each list, presented in a fixed quasi-random order, subject to the constraint that the same character did not occur consecutively. Four pairs of participants were randomly assigned to each list. There were four practice trials before the start of each block. To ensure that speakers were fully aware when their addressee could hear the preceding sentence or not, participants were asked to swap tasks during the practice sessions for each block (i.e., speakers had to play the addressee's role) and the experimenter reiterated that when the sentence was presented by the headphones, the addressee could not hear the sentence. The experiment took around 45 minutes.

Scoring. I scored whether participants produced a pronoun or a repeated noun phrase in cases where they referred to the referent character as the subject in the first sentence they produced. I excluded trials where participants did not refer to the referent character (N = 6); they used a different noun phrase instead of a repeated noun phrase (such s *the boy* rather than *the prince*) (N = 18) or dropped the subject (N = 1). In total, 25 trials (4.3% of responses) were excluded.

Results

Figure 14 presents the percentages of pronouns out of all pronoun and repeated noun phrase responses by condition. Analyses of variance were performed on arcsine-transformed proportions of pronouns, where condition was treated as a within-participants and -items variable and the participant/item lists (I-VI) were also included as a between-participants and between-items variable.

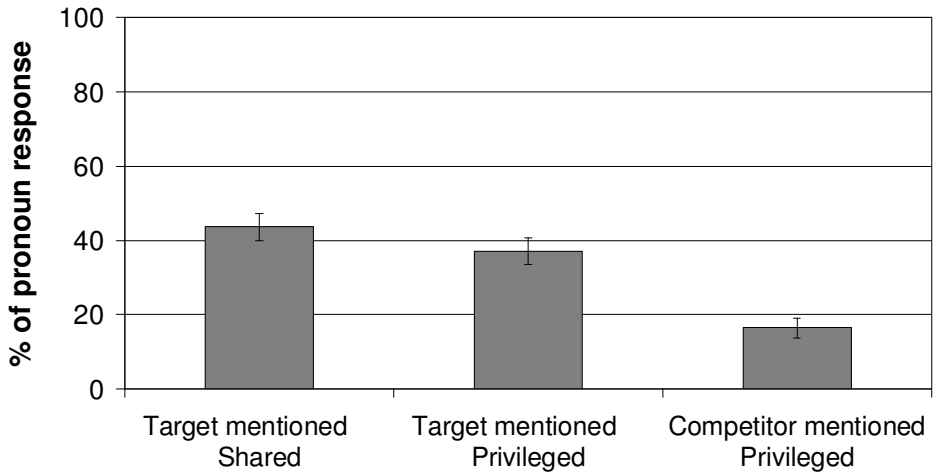

Figure 14. *Percentages of pronouns out of all pronouns and repeated NPs by condition (Experiment 1). Bars represent standard errors.*

The analyses revealed a main effect of condition, $F1(2, 36) = 12.64$, $p < .001$, $\eta_p^2 = .412$; $F2(2, 42) = 25.34$, $p < .001$, $\eta_p^2 = .547$. Pronouns were 21% less frequent in the competitor mentioned - privileged than in the target mentioned - privileged condition. Planned comparisons showed that this difference was significant, $F1(1, 18) = 18.22$, $p < .001$, $\eta_p^2 = .503$; $F2(1, 21) = 21.90$, $p < .001$, $\eta_p^2 = .511$. The 7% difference between the target mentioned-shared and the target mentioned-privileged condition did not reach significance by subjects, $F1 < 1$, though it was marginally significant by items, $F2(1, 21) = 3.22$, $p = .087$, $\eta_p^2 = .133$. See Appendix 7 for the results from logit mixed-effects modelling.

In addition, I analysed if the results were modulated by whether the immediately preceding sentence speakers heard was a correct description of the first panel by including correctness of the sentence (correct vs. incorrect description) as a

within-participants and between-items variable. Figure 15 provides the means by condition.

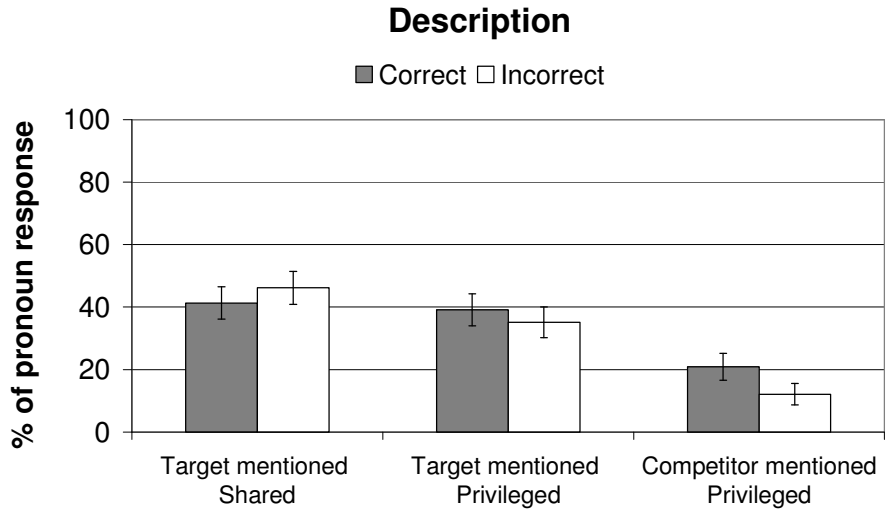

Figure 15. *Percentages of pronouns out of all pronouns and repeated NPs (Experiment 1) by correctness. Bars represent standard errors.*

The analyses showed no main effect of correctness, *F*s < 1, but there was a significant main effect of condition, $F1(2, 36) = 12.21$, $p < .001$, $\eta_p^2 = .404$; $F2(2, 36) = 28.06$, $p < .001$, $\eta_p^2 = .609$. Furthermore, there was a significant interaction between correctness and condition by participants, $F1(2, 36) = 3.33$, $p = .047$, $\eta_p^2 = .156$, but not by items, $F2(2, 36) = 1.75$, $p = .188$, $\eta_p^2 = .089$. I followed up this interaction by analysing the effects of context separately when the preceding sentence described the picture correctly and when it did not. In the correct description condition, pronoun use did not significantly differ between the target mentioned-shared (41%) and the target mentioned-privileged conditions (39%), *F*s < 1, whereas speakers produced significantly fewer pronouns in the competitor-mentioned privileged condition (21%) than in the target-mentioned privileged condition, $F1(1, 18) = 19.95$, $p < .001$, $\eta_p^2 = .526$; $F2(1, 9) = 6.90$, $p = .028$, $\eta_p^2 =$

.434. In the incorrect description condition, however, there was a marginal tendency for more pronouns in the target mentioned-shared (46%) than in the target mentioned-privileged condition (35%), though this difference did not reach significance by participants, $F1(1, 18) = 1.46$, $p = .243$, $\eta_p^2 = .075$ and was only marginal by items; $F2(1, 9) = 4.45$, $p = .064$, $\eta_p^2 = .331$. Pronoun use was significantly more frequent in the target mentioned-privileged condition (35%) than in the competitor mentioned-privileged condition (12%), $F1(1, 18) = 10.76$, $p = .004$, $\eta_p^2 = .374$; $F2(1, 9) = 26.95$, $p = .001$, $\eta_p^2 = .750$. Thus, the results suggested that the conditions had similar effects on the use of pronouns both for correct and incorrect descriptions. The interaction between the correctness of the sentence and condition was most likely due to the fact that correctness of the sentence did not significantly influence pronoun use in the target mentioned-shared condition, $F1(1, 18) = 2.76$, $p = .114$, $\eta_p^2 = .133$; $F2 < 1$, and in the target mentioned-privileged condition, $Fs < 1$, whereas in the competitor mentioned – privileged condition, pronouns were less frequent in the incorrect sentence condition (12%) than in the correct sentence condition (21%), though this difference was only significant by participants, $F1(1, 18) = 5.74$, $p = .028$, $\eta_p^2 = .242$, $F2(1, 18) = 3.46$, $p = .204$, $\eta_p^2 = .634$.

Discussion

Speakers produced more pronouns in the target mentioned - privileged than the competitor mentioned - privileged condition even though their addressee did not hear the second sentence in either condition. This suggests that speakers based their choice of referring expression on the referent's accessibility in their own discourse model rather than in the addressee's model. Furthermore, the difference between the

target mentioned - shared and target mentioned - privileged conditions was not significant, consistent with the idea that speakers relied on their own, privileged context. Additional analyses suggested that the overall pattern of results was the same regardless of whether the preceding sentence was a correct description of the first panel or not: There were significantly fewer pronouns when the immediately preceding sentence mentioned a competitor than the referent, whilst whether the target was mentioned in a shared or privileged context did not have a clear impact on the use of pronouns.

Experiment 2

Although the target mentioned - shared and the target mentioned - privileged conditions did not significantly differ in Experiment 1, the direction of the means might suggest that speakers took into account that the target character was more accessible to the addressee when the addressee could hear reference to the target in sentence (2a) compared to when s/he could not. However, the non-significant difference may have occurred *not* because speakers took into account the accessibility of the target for their addressee, but because regardless of whether the second sentence referred to the target character (and therefore made it more accessible) or not, they were somewhat more explicit in their referring expressions when the addressee did not share the same context.

Therefore, I conducted Experiment 2 by adding a new condition, where the immediately preceding sentence mentioning the competitor was presented by loudspeakers (*competitor mentioned-shared condition*), so both the speaker and the addressee heard reference to the competitor in the second context sentence. That is, I

orthogonally manipulated (a) whether the referent or competitor was mentioned in the immediately preceding sentence (2a vs. 2b) and (b) whether this sentence was shared with the addressee or not (experimental block with loudspeakers vs. block with headphones). The context sentence (1) and the photographs (Figure 13) were the same as in Experiment 1. If speakers generally use fewer pronouns when their addressee did not hear the immediately preceding sentence compared to when s/he did (i.e. they are generally more explicit when their addressee did not hear the sentence), we would expect that pronouns should be more frequent not only when their addressee heard the reference to the target but also when their addressee heard the reference to the competitor, compared to when s/he did not hear the sentence. That is, there should be a main effect of sharedness. In contrast, if speakers do take into account the referent's accessibility in the addressee's model, more pronouns are expected when the addressee heard reference to the target than when only the speaker heard reference to the target, but pronouns should be *less* frequent when the addressee heard reference to the competitor than when only the speaker heard this. This should result in an interaction between reference in second context sentence (target mentioned, 2a vs. competitor mentioned, 2b) and sharedness (shared vs. privileged).

Method

Participants. Thirty-two pairs of participants from the same population as in Experiment 1 took part. None of them had participated in the previous experiments.

Materials. The same 24 experimental items were used as in Experiment 1.

Procedure and design. These were the same as in Experiment 1, except for the following amendments. There was an additional condition in which the sentence mentioning the competitor (2b) was presented via loudspeakers. This resulted in a 2 × 2 within-participants and within-items design: Second context sentence (referent mentioned vs. competitor mentioned) × Sharedness (shared vs. privileged). Together with the 36 filler items, 24 items were distributed across four lists, each containing six items from each condition, and one version of each item. Sharedness was manipulated in blocks, and the order of the blocks as a between participants and items variable were counterbalanced. Thirty-two pairs of participants were randomly assigned to four lists, each containing 12 practice trials.

Scoring. Scoring was done in the same way as in Experiment 1. I excluded one trial that was due to a technical error and two trials in which addressees inadvertently manipulated the objects in response to the first sentence before the speaker produced the target description. In addition, one trial in which a participant referred to both characters as *they* and 15 trials in which participants used a different noun phrase instead of a repeated noun phrase were excluded. In total, 19 trials (2.5% of all responses) were excluded.

Results

Figure 16 presents the means. ANOVAs were conducted on the arcsine-transformed proportions of pronoun responses with reference in second context sentence and sharedness as within-participants and -items variables and participant/item list (I-IV) as a between-participants and -items variable. Correctness of the second sentence (correct vs. incorrect description) had no main effect, did not interact with either

reference in the second sentence or with sharedness (all *Fs* < 1), and did not produce a three way interaction, $F1(1, 28) = 2.05$, $p = .163$, $\eta_p^2 = .068$, $F2(1, 16) = 1.08$, $p = .313$, $\eta_p^2 = .063$. Given that it was merely a counterbalancing variable, the reported means and analyses were collapsed across correctness of the second sentence.

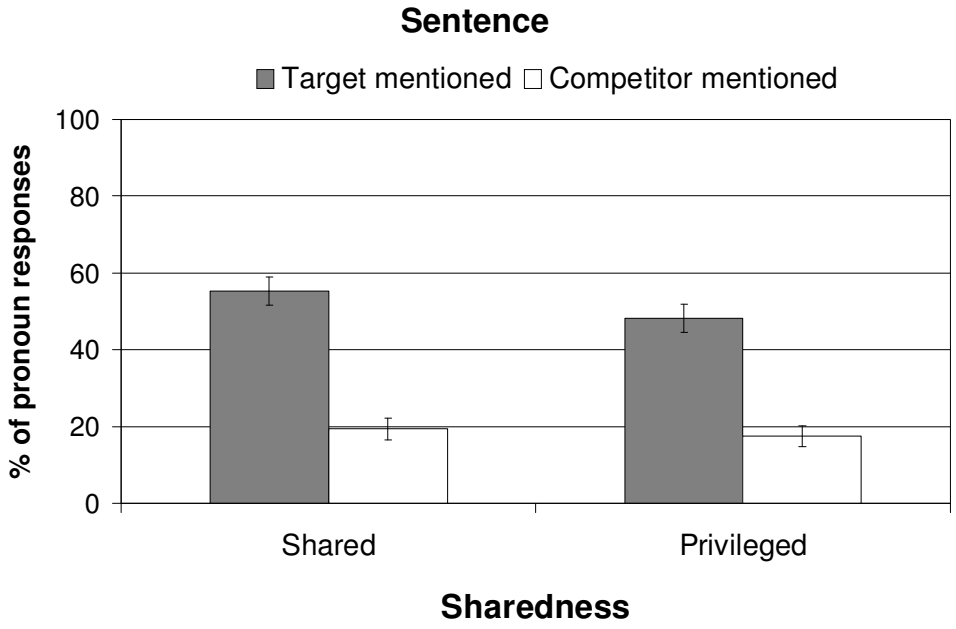

Figure 16. *Percentages of pronouns out of all pronouns and repeated NPs by sentence and sharedness (Experiment 2). Bars represent standard errors.*

The analyses revealed a main effect of second sentence reference, $F1(1, 28) = 46.28$, $p < .001$, $\eta_p^2 = .623$, $F2(1, 20) = 148.51$, $p < .001$, $\eta_p^2 = .881$, indicating that participants used more pronouns when the preceding sentence mentioned the referent (52%) than the competitor (19%). The main effect of sharedness was not significant by participants, $F1(1, 28) = 1.98$, $p = .171$, $\eta_p^2 = .066$, but very close to significance by items, $F2(1, 20) = 4.19$, $p = .054$, $\eta_p^2 = .173$, which indicated a tendency for fewer pronouns in the privileged than in the shared condition. Importantly, there was no significant interaction between reference in the second sentence and sharedness,

*F*s < 1. Planned comparisons revealed that the effect of context sentence was significant in both the shared $F1(1, 28) = 42.94$, $p < .001$, $\eta_p^2 = .605$; $F2(1, 20) = 70.14$, $p < .001$, $\eta_p^2 = .778$ and privileged conditions, $F1(1, 28) = 31.30$, $p < .001$, $\eta_p^2 = .528$; $F2(1, 20) = 99.93$, $p < .001$, $\eta_p^2 = .833$. See Appendix 7 for the results from logit mixed-effects modelling.

Discussion

Pronouns were more frequent when the second sentence mentioned the referent (2a) than the competitor (2b), indicating that the referent was more accessible when it was mentioned in the immediately preceding sentence than when the competitor was mentioned. Crucially, this effect was not modulated by whether the sentence was shared or privileged, and speakers significantly increased pronoun use when the immediately preceding sentence mentioned the referent rather than the competitor even if it was not shared with their addressee. In addition, there was a marginally significant tendency for fewer pronouns when the addressee did not listen to the second sentence than when s/he did. This may suggest that speakers were inclined to reduce pronoun use whenever their addressee did not share the same linguistic context, regardless of whether the context made the referent or the competitor accessible. This may represent a coarse form of audience adaptation, but this does not require speakers to model how accessible the referent is in the addressee's discourse model, because all speakers need to know is whether the addressee heard the preceding sentence.

In contrast, to compute how accessible the referent is to the addressee, they would have to know not only whether the addressee heard the preceding sentence but

also what entity was mentioned in that sentence. These two pieces of information then need to be combined: The referent is more accessible to the addressee when s/he heard the sentence that mentioned the referent than when s/he did not, but the referent is *less* accessible when the addressee heard the sentence that mentioned the competitor than when s/he did not. Given that speakers clearly knew which character was mentioned in the preceding sentence (fewer pronouns in the competitor-mentioned than the referent-mentioned condition), the lack of addressee accessibility effect was most likely due to speakers failing to combine multiple sources of information.

General Discussion

Both Experiments 1 and 2 showed that the referent's accessibility in the speaker's own, privileged discourse model affected the choice of referring expressions. Experiment 1 found that in conditions where the preceding sentence was not shared with the addressee, speakers nevertheless produced significantly more pronouns when this sentence made the referent salient than when it made the competitor salient, indicating that they did not take into account whether the referent was accessible for the addressee or not. Experiment 1 also showed a non-significant tendency for speakers to produce more pronouns when the addressee heard the sentence that made the referent more salient than when the addressee did not. However, Experiment 2 showed that this tendency occurred regardless of whether the preceding sentence made the referent or the competitor salient. This suggests that speakers may have been somewhat more explicit when the preceding sentence was shared with their addressee than when it was not, but they did not take into account

whether this sentence made the referent or the competitor salient to the addressee. Most importantly, Experiment 2 showed that speakers produced more pronouns when the preceding sentence made the referent salient compared to when it made the competitor salient, and that this effect was equally large when the addressee could hear the preceding sentence as when the addressee could not hear it. Thus, the results indicate that speakers chose the form of referring expression based on the referent's accessibility in their own rather than the addressee's discourse model, providing evidence against claims that speakers use the referent's accessibility in the addressee's discourse model when they choose referring expressions (e.g., Ariel, 1990; Chafe, 1994; Givón, 1983a; Prince, 1985); speakers do not choose referring expressions to signal how accessible a discourse entity is in the addressee's discourse model.

The finding that speakers do not take the addressee's perspective contrasts with studies which show evidence for audience design in cases where failing to take the addressee's perspective would make reference ambiguous or that would result in referential failure. In studies showing that speakers take into account the addressee's familiarity with a particular topic or referring expression (e.g., Brennan & Clark, 1996; Isaacs & Clark, 1987; Horton & Gerrig, 2002; 2005a; Wilkes-Gibbs & Clark, 1992), speakers had to adapt their reference to their addressee because they knew that the addressee, who was unfamiliar with the referent or the referring expression, might not be able to uniquely identify the referent. In studies showing that speakers use the addressee's visual perspective to avoid referential ambiguity (Horton & Keysar, 1996; Nadig & Sedivy, 2002), disambiguation was necessary when the addressee could see the competitor, whereas it was not when the addressee could not see the competitor. Similarly, in Matthews et al. (2006), which showed that 3 and 4

year-old children take the addressee's visual perspective when using unheralded pronouns, unheralded pronouns did not identify the referent when the referent was invisible to the addressee. In contrast, in our experiments, both the use of a definite noun phrase and a pronoun resulted in unambiguous reference, because the different gender of the referent and the competitor rendered pronouns unambiguous. Therefore, the use of a pronoun did not result in communicative failure that could have compelled the speaker to model the addressee's representation.

One possibility is that when speakers perceive a risk of communicative failure, for example because the referential context contains a referential competitor that is conceptually identical to the referent (Horton & Keysar, 1996; Nadig & Sedivy, 2002) or because they know that the addressee is not familiar with the topic or the expression that refers to it (Brennan & Clark, 1996; Issac & Clark, 1992; Wilkes-Gibbs & Clark, 1992; Horton & Gerrig, 2002; 2005a), they try to avert such a risk, which will increase their sensitivity to the perspective of the addressee. That is, when speakers become aware of potential referential failure, they adopt the addressee's model to adjust it. But when speakers do not perceive such a risk, speakers use their own perspective to produce referring expressions. In short, speakers must become aware that audience design is necessary in order for them to produce referring expressions that are helpful for their addressee rather than those that are easier for them to produce (Horton & Gerrig, 2002). One possible reason for this is that constant updates of the addressee's current knowledge status is too cognitively-demanding (Horton & Keysar, 1996; Rossnagel, 2000) to engage within the time frame of utterance planning (Horton & Gerrig, 2005a). Thus, our results are largely consistent with accounts that assume that interlocutors use their "egocentric" model for spontaneous, routine linguistic processing, while the addressee's

knowledge and cognitive state have an influence only under unusual circumstances (e.g., Dell & Brown, 1991; Keysar, Lin, & Barr, 2003; Pickering & Garrod, 2004).

However, if speakers are egocentric and use their own discourse model when choosing referring expressions, why do they not always use reduced referring expressions such as pronouns, which are presumably much easier to produce than more explicit referring expressions because they are shorter, more frequent and contain less semantic information (Ariel, 1990; Almor, 1999)? In fact, if speakers were completely insensitive to the addressee's needs for comprehension, we might expect that they are more likely to produce explicit referring expressions such as definite noun phrases when their referent is more rather than less accessible. When the referent's saliency is high, it should be relatively easy to access a noun describing it, because the semantic information needed for lexical retrieval is accessible (e.g., interference from other competing information is weak). Furthermore, if the referent is salient in the linguistic context, its phonological form may also be easily accessible (repeating a recently mentioned word is easier than producing a word that has not been mentioned). In contrast, when the referent's saliency is low, accessing a noun that describes it should be harder.

One possible reason for why speakers do not always use pronouns is because they choose referring expressions depending on the referent's accessibility in their own discourse model. That is, speakers use their own discourse model as a proxy for their addressee's (cf. Dell & Brown, 1991; Pickering & Garrod, 2004). When the referent is highly accessible in their own discourse model, they choose reduced referring expressions such as pronouns, because they assume that the referent is equally accessible in the addressee's model and very little information is needed for identification, whereas when the referent is less accessible in their own discourse

model, they choose more explicit referring expressions because they assume that the referent is less accessible in their addressee's model and the addressee requires more information to identify the referent. In most cases, as discourse progresses, the interlocutors' representations tend to converge (cf., Brown & Dell, 1987; Pickering & Garrod, 2004), so what is accessible for speakers is also accessible for the addressee. Because of this "alignment" of speaking and listening, using one's own perspective permits the production of referring expressions that are adapted for the addressee's comprehension.

During normal conversation, speakers seem to decide whether to use pronouns or definite noun phrases rather rapidly, seemingly without any conscious reflection upon the communicative functions of these referring expressions. This seemingly automatic process makes sense if we assume that the relationship between the referent's accessibility and the explicitness of the expression has not only evolved out of the speaker's adaptation for the addressee's comprehension but is also the result of the production-internal constraints. That is, speakers choose referring expressions depending on the level of accessibility of the referent's representation in their memory, or more precisely, how much semantic reaccess is needed when they initiate language production processes to refer to a discourse entity. Models of language production (e.g., Bock & Levelt, 1994; Levelt, 1989) assume that language production is initiated by the formulation of the concept a speaker wants to express, which serves as input for subsequent linguistic encoding. When the referent is highly salient in the discourse context, the referent's semantic representation is already highly accessible, so relatively little semantic reaccess is needed. As a result of this, speakers may be more likely to produce semantically-impoverished referring expressions such as pronouns. Conversely, when the referent is less accessible,

reaccessing the referent requires more semantic reactivation, which may result in the production of semantically-richer referring expressions such as definite noun phrases.

In sum, the current study suggests that speakers do not routinely take the addressee's discourse model when choosing pronouns and definite noun phrases, but instead choose referring expressions depending on how accessible the referent is in their own discourse model. Essentially, I assume that during normal conversation, using one's own perspective as a proxy to the addressee's may suffice for producing referring expressions that are adapted for the addressee's comprehension. This obviates the need of constant, resource-demanding updates of the addressee's perspective.

Animacy

Introduction

It is generally assumed that language users produce different referring expressions depending on the cognitive status of the referent in their mental representation. When the referent is highly accessible, they tend to favour reduced referring expressions such as pronouns, whereas more explicit expressions are preferred for less accessible entities (e.g., Ariel, 1990; Gundel, et al., 1993). A critical question is therefore what information affects the referent's accessibility. Research has identified various contextual factors that affect accessibility and hence the choice of referring expression. For instance, people are more likely to use reduced referring expressions such as pronouns if the referent has been mentioned more recently in the discourse (Ariel, 1990; Givón, 1983a). Furthermore, they favour pronouns when referring to an entity within the same rather than a different episode in the discourse (Anderson, et al., 1983) and when they refer to the grammatical subject rather than object in the preceding sentence (Arnold, 2001; Brennan, 1995; Fletcher, 1984; Fukumura & Van Gompel, 2010; Stevenson, et al., 1994). Other research has suggested that the choice of referring expression is also affected by the presence of a referential competitor in the prior linguistic or extra-linguistic context (Ariel, 1990; Arnold & Griffin, 2007; Clancy, 1980; Fukumura, et al., 2010, Chapter 3).

However, such focus on referential context raises the question of whether only contextual information affects accessibility or whether non-contextual factors also affect the referent's accessibility and hence the form of reference. The current

study therefore investigates whether the referent's inherent accessibility (Prat-Sala & Branigan, 2000) affects the choice of expression by focusing on the role of animacy in the choice of pronouns and repeated noun phrases during anaphoric reference.

Many linguistic theories assume that human referents are more accessible than animal referents, and animal referents are more accessible than inanimate referents (Aissen, 2003; Comrie, 1989; Foley & Van Valin, 1985; Silverstein, 1976). Several reasons for this have been suggested. Some researchers have argued that animate entities are more accessible because language users tend to view the world from animates' perspective (Ehrlich, 1990; Kuno & Kaburaki, 1977) or have empathy towards them (Kuno & Kaburaki, 1977; Langacker, 1991). Others have pointed out that animate entities can initiate actions, whereas inanimates cannot (Fowler, 1977), so animates are more often responsible for actions or events (Davidson, 1971). Relatedly, more predicates apply to animates than inanimates, which may make animates conceptually more accessible than inanimates (Bock & Warren, 1985). Indeed, corpus studies has showed that animates are mentioned more frequently than inanimates (Givón, 1983a) and are more likely to be the sentential subject than inanimates (Clark & Begun, 1971; Itagaki & Prideaux, 1985; Pearson, Stevenson, & Poesio, 2001), suggesting that predicates may be more accessible for animates than inanimates. One possibility is that the referent's animacy affects the choice of referring expression, not only because it influences the referent's accessibility itself, but also because it influences the accessibility of its predicate: Reduced expressions such as pronouns may be more frequent when the predicate is more accessible (with animate referents), because they allow faster production of the predicate compared to more explicit referring expressions.

Research has shown that animacy affects the choice of syntactic structure: People are more likely to produce passive relative to active constructions if the patient is animate than inanimate in English (Bock et al., 1992; Ferreira, 1994; McDonald, Bock, & Kelly, 1993; Prat-Sala & Branigan, 2000), Japanese (Branigan, Pickering, & Tanaka, 2008), German (Van Nice & Dietrich, 2003) and Spanish (Prat-Sala & Branigan, 2000). Animacy also affects constituent order. Using languages such as Greek and Japanese, which are freer in their constituent order than English, Branigan et al. (2008) showed that speakers preferentially produce an animate prior to an inanimate noun phrase, independent of their grammatical functions. Similarly, in English, the Saxon genitive (e.g., *the king's palace*) is preferred over the Norman genitive (e.g., *the palace of the king*), when the possessor (*the king*) is animate, whereas the Norman genitive is preferred when the possessor is inanimate (Rosenbach, 2002).

But so far, very few studies have investigated whether animacy affects choice of referring expression, except for a few corpus studies (Dahl & Fraurud, 1996; Yamamoto, 1999). Dahl and Fraurud (1996) analysed non-fiction Swedish written texts. Their analyses showed that human entities were 28% more likely to be pronominalised than non-human entities, suggesting that animacy affects the use of pronouns. But their corpus also showed that subjects in transitive clauses were 13% more likely to be human than non-human. It is therefore possible that the animacy effect on pronoun use arose because animates are more often the sentential subject in the antecedent sentence than inanimates (Clark & Begun, 1971; Itagaki & Prideaux, 1985; Pearson et al., 2001) and pronouns are more frequent for subject antecedents than other antecedents (Arnold, 2001; Brennan, 1995; Fletcher,1984; Fukumura & Van Gompel, 2010; Stevenson et al., 1994). Therefore, it is unclear whether animacy

affects the frequency of pronoun use when the antecedent's syntactic status is controlled. The same issue arises for Yamamoto's (1999) corpus analyses of English and Japanese, which reported that pronouns were 18% (in English) and 5% (in Japanese) more frequent for animates than inanimates. However, it is possible that the animate and inanimate entities differed with respect to discourse factors, including the antecedent's grammatical role and sentence position.

Thus, three experiments investigated the effect of animacy on the use of pronouns and repeated noun phrases by examining reference to human versus non-human, inanimate referents introduced in the preceding sentence. I used a written sentence completion task, which has been used in previous studies investigating reference production (e.g., Garvey & Caramazza, 1974; Fukumura & Van Gompel, 2010; Stevenson et al., 1994, 2000). Experiment 1 examined the role of animacy when the grammatical role and position of the referent in the preceding sentence were counterbalanced. To anticipate the results, participants used more pronouns (and fewer repeated noun phrases) to refer to animate than inanimate referents. Experiments 2 and 3 examined whether choice of referring expression is only affected by the animacy of the referent, or whether it is also affected by the animacy of another discourse entity (a referential competitor).

Experiment 1

Materials such as (1) were used to investigate whether the referent's animacy, either human animate (*the hikers*) or inanimate (*the canoes*), affects the choice of a pronoun (*they*) over a repeated noun phrase when participants referred back to the first-mentioned subject (NP1) or the second-mentioned object noun phrase (NP2) in

their completions. In (1a), NP1 is a human, animate noun phrase (*the hikers*) and NP2 a non-human, inanimate noun phrase (*the canoes*). In (1b), the grammatical role and linear position of the noun phrases are reversed.

1a. The hikers carried the canoes a long way downstream. Sometimes, ...

1b. The canoes carried the hikers a long way downstream. Sometimes, ...

I used plural noun phrases because pronouns for singular human (*he/she*) and inanimate antecedents (*it*) differ, so there may be factors other animacy that could affect their choice. In contrast, plural pronouns for human and inanimate entities are the same (*they*). If the referent's animacy affects the choice of referring expression, participants should produce more pronouns when the referent is animate than inanimate. In addition, in line with previous studies (e.g., Arnold, 2001; Fukumura & Van Gompel, 2010; Stevenson et al., 1994), I predicted that structural properties should affect the choice of referring expression, with more pronouns when participants referred to NP1 than NP2.

Experiment 1a investigated the referent's animacy using a free completion method, where participants were free to choose to which entity they referred, whereas Experiment 1b used a constrained completion task, where participants had to refer to NP1 or NP2 in the first sentence (Fukumura & Van Gompel, 2010).

Experiment 1a: Free completion method

Methods

Participants. Thirty-eight students from the University of Dundee took part. They all reported to be native speakers of British English and non-dyslexic.

Items. I constructed 56 experimental items such as (1), consisting of a context sentence and a sentence fragment. The context sentence described an event using an animate, human plural noun phrase (*the hikers*), a verb (*carried*), an inanimate plural noun phrase (*the canoes*), and a prepositional or adverbial phrase (*a long way downstream*). The sentence fragment consisted of a single adverb, followed by a series of dots indicating that participants had to provide a continuation. In the animate-inanimate condition (1a), the animate, human noun phrase was the subject and was mentioned first, whereas the inanimate noun phrase was the direct object and mentioned second. In the inanimate-animate condition (1b), the order of the noun phrases was reversed. I also constructed 58 filler items consisting of a context sentence varying in structure followed by an adverb. See Appendix 8.

Design. Fifty-six experimental items were tested in two conditions (animate-inanimate and inanimate-animate). Thirty-eight participants were randomly assigned to two lists, each of which consisted of 28 items from each condition, together with 58 filler items. The items occurred in a fixed random order with at least one filler between experimental items.

Procedure. Participants were given a booklet containing the items and asked to produce a continuation to each sentence fragment. They were told to do this quickly but in a meaningful way. Both written and oral instructions were provided. There was no time limit. The experiment typically lasted approximately 60 minutes, including a break.

Scoring and analyses. I scored whether participants used a pronoun or repeated noun phrase and whether they referred to NP1 or NP2. Because completions with the pronoun *they* were potentially ambiguous, two scorers determined whether it referred to NP1 or NP2. One of the scorers was naïve to the

purposes of the experiment. For the analyses, I selected those completions for which both scorers agreed about the antecedent of *they*. In total, I excluded 45% of all responses (N = 959) because participants did not refer to either of the noun phrases (N = 909); one of the scorers considered the pronoun ambiguous or the scorers disagreed about the antecedent of the pronoun (N = 48); participants produced non-target expressions: a demonstrative expression (*these*) (N = 1) or a non-repeated noun phrase (N = 1).

Results

Figure 17 presents the percentages of pronoun responses (out of all pronoun and repeated noun phrase responses) by antecedent position (NP1 vs. NP2) and animacy (animate vs. inanimate).

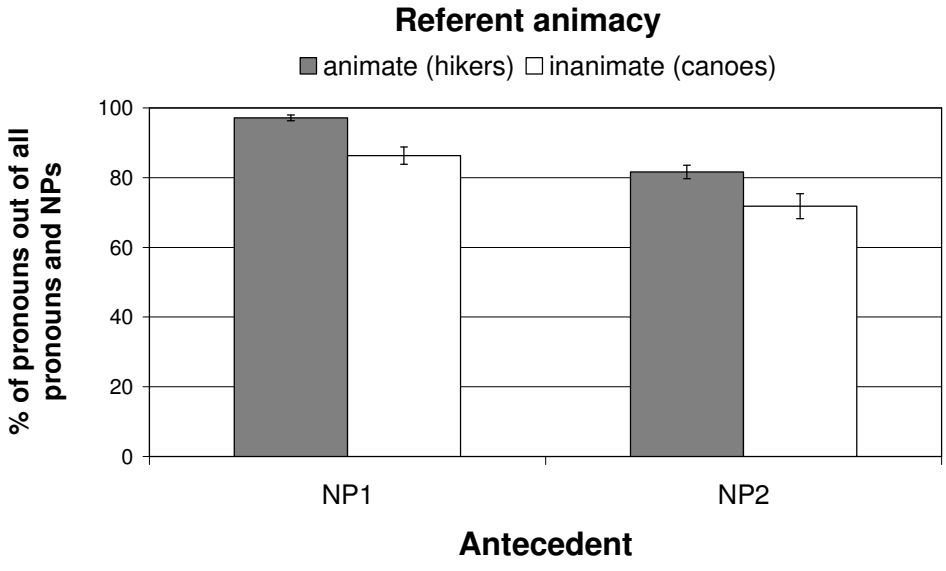

Figure 17. *Percentages of pronouns out of all pronouns and repeated NPs by animacy and antecedent (Experiment 1a). Bars represent standard errors.*

I carried out ANOVAs on the Arcsine e-transformed proportions, by including antecedent position (NP1 vs. NP2) and animacy (animate vs. inanimate) as within-participants and -items variables and participant/item list (I-II) as between-participants and -items variables. One participant who never referred to NP1 in the inanimate-animate condition was eliminated from the by-participants analyses and 22 items that had no reference to the inanimate entity in at least one condition were removed from the by-items analyses.

The analyses showed a main effect of antecedent position: Participants produced more pronouns when the referent was NP1 (92%) than NP2 (77%), $F1(1, 35) = 19.94$, $p < .001$, $\eta_p^2 = .363$; $F2(1, 32) = 24.62$, $p < .001$, $\eta_p^2 = .435$. More important, there was a main effect of animacy, $F1(1, 35) = 12.36$, $p = .001$, $\eta_p^2 = .261$; $F2(1, 32) = 7.91$, $p = .008$, $\eta_p^2 = .198$, such that participants produced more pronouns when the referent was human animate (89%) than inanimate (79%), indicating that the referent's animacy affected the choice of referring expression. There was no interaction between antecedent position and animacy, $F1(1, 35) = 1.12$, $p = .298$, $\eta_p^2 = .031$; $F2 < 1$.

Table 6. *Percentages of references to NP1 out of all NP1 and NP2 references by animacy order (Experiment 1a)*

Animate-inanimate	73.2 (1.8)
Inanimate-animate	32.4 (1.9)

Note: Standard errors in parentheses.

In addition, I examined which entity participants referred to by analysing the proportion of trials on which participants referred to NP1 (relative to the total

number of references to either NP1 or NP2) using either a pronoun or repeated noun phrase. Table 6 presents the percentages of NP1 references by animacy order (animate-inanimate versus. inanimate-animate). Analyses of variance were conducted on both participant and item means with the variable animacy order as within-participants and within-items variables and participant/item list (I-II) as a between participants or -items variable. The analyses revealed an effect of animacy order, $F1(1, 36) = 218.02$, $p < .001$, $\eta_p^2 = .858$; $F2(1, 54) = 60.52$, $p < .001$, $\eta_p^2 = .528$, with 41% more NP1 references in the animate-inanimate condition than in the inanimate-animate condition. Subsequent analyses showed that NP1 references were higher than chance in the animate-inanimate condition, $F1(1, 36) = 100.01$, $p < .001$, $\eta_p^2 = .735$; $F2(1, 54) = 33.78$, $p < .001$, $\eta_p^2 = .385$, whereas they were lower than chance in the inanimate-animate condition, $F1(1, 36) = 70.47$, $p < .001$, $\eta_p^2 = .662$; $F2(1, 54) = 29.41$, $p < .001$, $\eta_p^2 = .353$. Thus, participants referred more often to the animate than the inanimate entity in both animacy orders. See Appendix 9 for the results from logit mixed-effects modelling.

Discussion

Consistent with past research (Clark & Begun, 1971; Itagaki & Prideaux, 1985; Pearson, et al., 2001), animates were more frequently chosen as the subject of the continuation than inanimates. Most importantly, pronouns (relative to repeated noun phrases) were more frequent for animates than inanimates. Because discourse factors such as the antecedent's structural role and frequency of mention were controlled in the current experiment, the results provide the first clear evidence that the referent's animacy affects the choice of pronouns and repeated noun phrases.

Experiment 1b: Constrained completion method

Experiment 1a provided preliminary evidence that the referent's animacy affects the choice of referring expression. However, there was a very limited number of observations for inanimate referents, and there were many responses where participants referred to neither NP1 nor NP2 in the first sentence. To address this issue, a constrained completion experiment was conducted by indicating whether participants should refer to NP1 or NP2 with an arrow, as illustrated in (2a-d). In a series of written sentence completion experiments investigating the choice of referring expression, Fukumura and Van Gompel (2010) obtained the same pattern of results with this method as with the free completion method used in Experiment 1a, so I expected that Experiment 1b should show the same pattern of results as Experiment 1a.

2a. The ▼hikers carried the canoes a long way downstream. Sometimes, ...

2b. The hikers carried the ▼canoes a long way downstream. Sometimes, ...

2c. The ▼canoes carried the hikers a long way downstream. Sometimes, ...

2d. The canoes carried the ▼hikers a long way downstream. Sometimes, ...

Method

Participants. Thirty-two students from the same population as in Experiment 1a took part. None of them had participated in Experiment 1a. Data from two

additional participants were excluded, because more than 25% of their responses had to be excluded (for the scoring criteria, see below).

Items. Because reference was constrained, I expected there should be fewer trials that had to be excluded than in Experiment 1a. Therefore, I decided to reduce the number of experimental items to 40, so that the proportion of experimental trials relative to fillers was lower than in Experiment 1a without increasing the length of the experiment. The 40 experimental items were randomly selected from the same items used in the free completion task. See Appendix 8 for a list of all materials. For each item, an arrow indicated whether completions should start with reference to NP1 or NP2, as shown in (2a-d). The 58 filler items were identical to those used in Experiment 1a, except that each filler had an arrow indicating that participants had to refer to one of the noun phrases.

Design. Forty experimental items were tested in four conditions, defined by the variables antecedent position (NP1 vs. NP2) × animacy (animate vs. inanimate). Thirty-two participants were randomly assigned to four lists, each of which consisted of 10 items from each condition, together with 58 filler items. The items appeared in a fixed random order, with at least one filler between experimental items.

Procedure. Participants were given a booklet with the items and were asked to start their continuations with a reference to the words with an arrow above it. They were told that they could use either a pronoun (*they, it, he or she*) or a noun (e.g., *the bridges* or *the photographer*). Participants received both written and oral instructions. There was no time limit, and the experiment typically lasted 40-50 minutes.

Scoring and analyses. I scored whether participants produced a pronoun or repeated noun phrase to refer to the specified antecedent. Trials were excluded when participants did not follow the arrow (N = 6), the referent was not the subject in the completion (N = 6), participants used non-target expressions, either using singular pronouns (N = 6), singular noun phrases (N = 12), indefinite noun phrases (N = 8), demonstrative expressions (N =1) or expressions like *none of them*, *no one*, *many* (N = 3). In total, I excluded 3% of all responses (N = 42).

Results

Figure 18 presents the percentages of pronouns.

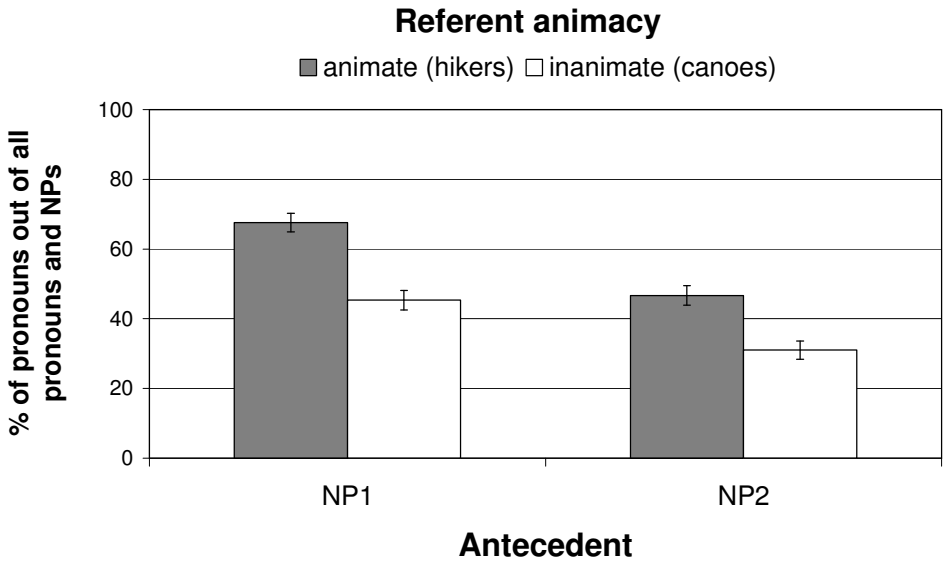

Figure 18. *Percentages of pronouns out of all pronouns and repeated NPs by animacy and antecedent (Experiment 1b). Bars represent standard errors.*

Arcsine transformed proportions of pronoun responses were submitted to ANOVAs with antecedent sentence position (NP1 vs. NP2) and animacy (animate vs. inanimate) and as within-participants and -items variables, and participant/item list

(I-IV) as a between-participants or -items variable. The analyses showed a main effect of antecedent position, $F1(1, 28) = 49.31$, $p < .001$, $\eta_p^2 = .638$; $F2(1, 36) = 62.77$, $p < .001$, $\eta_p^2 = .636$, with more pronouns (relative to noun phrases) being produced for NP1 (56%) than NP2 (38%). Most importantly, there was a main effect of animacy, with more pronouns being produced to refer to human animate (57%) than inanimate entities (38%), $F1(1, 28) = 35.24$, $p < .001$, $\eta_p^2 = .557$; $F2(1, 36) = 64.56$, $p < .001$, $\eta_p^2 = .642$. The interaction between antecedent position and animacy was non-significant by participants, $F1 < 1$, and only marginal by items, $F2(1, 36) = 3.09$, $p = .087$, $\eta_p^2 = .079$. See Appendix 9 for logit mixed-effects results.

Discussion

As in previous research (Fukumura & Van Gompel, 2010), the free and constrained completion methods showed the same pattern of results. When the antecedent's grammatical role and position were controlled, animacy had an independent effect on the choice of pronouns and repeated noun phrases, with more pronouns for animate than inanimate referents. This suggests that the referent's inherent properties affect its accessibility and the choice of pronouns over more explicit referring expressions. In addition, consistent with previous research, participants produced more pronouns for NP1 than NP2, indicating that the referent's structural properties in the preceding sentence also had an effect. The overall preference for pronouns over repeated noun phrases was less pronounced in the constrained than the free completion task, perhaps because the constrained task may have highlighted that both referring expressions could be used. Most important, however, the animacy and antecedent position effects were reliable with both methods.

Experiment 2

Experiment 1 showed that people choose pronouns more often for animate than inanimate antecedents. An important question is how animacy affects the choice of referring expression. One possibility is that the choice of referring expression is determined by the referent's accessibility relative to the accessibility of its competitors: The more accessible the competitors are, the less accessible the referent is. One reason for this may be that language users actively maintain their discourse representations in working memory (Almor, 1999; Kintsch & Van Dijk, 1978; Sanford & Garrod, 1981), and choose referring expressions depending on how much attention they have allocated to each discourse entity in their working memory. Because such attentional resources are assumed to be capacity constrained (e.g., Baddeley, 1986; Broadbent, 1958; Just & Carpenter, 1992; Kahneman, 1973), the total amount of activation for all discourse entities may remain constant: If the activation of one entity is increased, the activation of all other entities must be reduced in order not to exceed the total activation capacity. Indeed, evidence from the attention literature suggests that the presence of irrelevant stimuli can interfere with and compete for resources during the processing of the target stimuli (e.g., Eriksen & Eriksen, 1974; Stroop, 1935). This account predicts that the referent's accessibility should be reduced when the competitor is animate relative to when it is inanimate, so people should produce fewer pronouns when the competitor is animate than inanimate. Alternatively, language users may not actively maintain discourse entities in capacity-constrained focal attention (Foraker & McElree, 2007), and therefore an entity’s accessibility may not be constrained by the accessibility of other entities. This account predicts that a competitor’s animacy should not affect the

choice of referring expression; only the animacy of the referent should have an effect.

Whether the competitor's animacy affects the referent's accessibility was previously examined by García (1996), who examined the effect of competitor animacy during intra-sentential reference in Spanish. She investigated the choice between *él*, which specifies the referent's gender and number (singular masculine), and *sí*, which does not. Her participants were asked to fill in the blanks in the prepositional phrases in (3a) and (3b) by either using *él* or *sí*. In (3a), the prepositional phrase follows an inanimate direct object (*un libro* 'a book'), whereas in (3b), the direct object was an animate, human noun phrase (*al hijo* 'his son'). Participants chose *sí* less frequently when the competitor was animate (3b) than inanimate (3a). Thus, García concluded that the competitor's animacy affects the referent's accessibility; when the competitor is animate, the referent is less accessible than when the competitor is inanimate.

3a. Juan siempre lleva un libro con __ cuando va de vacationes.
'John always takes a book with __ when he goes on vacation.'

3b. Parecería que Rodolfo no puede estar solo: siempre lleva al hijo con ___, dondequiera que vaya.
'Rodolfo seems unable to be alone: he always takes his son with ____, wherever he goes.'

However, García only tested two sentences (3a and 3b), so it is difficult to generalise to other sentences. Specifically, in (3b) the animacy of the referent and competitor is the same (both are animate), whereas the animacy of the referent and

competitor is different in (3a). It is possible that participants used the less informative *sí* less frequently when the two entities had the same animacy than when they had a different animacy. This alternative explanation is consistent with Arnold and Griffin (2007), who argued that when two discourse entities are semantically similar, it causes interference during reference production and reduces the referent's accessibility. They suggested that this may explain why in their and other studies (e.g., Clancy, 1980; Arnold, Eisenband, Brown-Schmidt, & Trueswell, 2000) pronouns were less frequent when the context included a competitor of the same gender as the referent (and was therefore semantically similar to the referent) than when the competitor had a different gender (and was therefore less similar). In a similar way, because entities with the same animacy are semantically more similar than entities with a different animacy, the referent may have been less accessible in (3b) than in (3a). This semantic interference account is different from the view that the competitor's animacy has an independent effect on the frequency of pronouns because the latter account predicts that the referent should be less accessible when the competitor is animate than inanimate, independent of the animacy of the referent.

Experiment 1 did not determine whether the competitor's animacy affected the choice of referring expression, because when the referent was animate the competitor was inanimate, and when the referent was inanimate, the competitor was animate. To examine the effect of competitor animacy, Experiment 2 used items such as (4), where the animacy of the noun phrases was orthogonally manipulated: When NP1 was human animate (*the rowers*), NP2 was either human animate (*the swimmers*) or inanimate (*the yachts*), and when NP1 was inanimate (*the boats*), NP2 was also either animate or inanimate.

4a. The rowers overtook the swimmers in the end. Clearly, ...

4b. The rowers overtook the yachts in the end. Clearly, ...

4c. The boats overtook the swimmers in the end. Clearly, ...

4d. The boats overtook the yachts in the end. Clearly, ...

If the competitor's animacy affects the referring expression for the referent, participants should produce fewer pronouns (and more noun phrases) when the competitor is animate (4a and 4c) than when it is inanimate (4b and 4d). In addition, we may also observe evidence for semantic interference. Participants may produce fewer pronouns in (4a) and (4d), where NP1 and NP2 have the same animacy and are therefore semantically similar, than in (4b) and (4c), where they have a different animacy and are semantically less similar. This should result in an interaction between referent and competitor animacy. I will refer to this as the *animacy congruency effect*.

I used a constrained completion method, because I could only construct a limited number of items (N = 24) with verbs (e.g., *overtook*) that allowed both arguments to be either animate or inanimate. In the free completion task in Experiment 1a, participants referred to neither NP1 nor NP2 in the first sentence in more than 45% of trials, and if they did, they hardly referred to inanimate entities. Therefore, and given that the results of the free and constrained completion methods yielded the same pattern of results in both Experiment 1 and in Fukumura and Van Gompel (2010), I used a constrained completion method, and because antecedent position (NP1 vs. NP2) was not the main focus of investigation, I included it as a between-participants variable: in Experiment 2a, participants had to refer to NP1, whereas in Experiment 2b, they referred to NP2.

Method

Participants. Seventy-two new participants from the same population as before took part (36 each in Experiments 2a and 2b). Data from additional two participants were collected but were excluded from further analyses, because they produced more than 25% responses that had to be excluded (see below for scoring criteria).

Items. I constructed 24 experimental items such as (4a-b); see Appendix 8. The structure of the first sentence was the same as in Experiment 1. In Experiment 2a, arrows (▼) indicated that participants should start their continuation with a reference to NP1**,** whereas in Experiment 2b, arrows were placed above NP2. I orthogonally manipulated the animacy of NP1 (human animate *the rowers* vs. inanimate *the boats*) and the animacy of NP2 (human animate *the swimmers* vs. inanimate *the yachts*). There were 51 filler items. In Experiment 2a, an arrow pointed to non-subject NPs in 39 filler items, whereas in Experiment 2b, it pointed to sentence-initial subjects in 31 filler items.

Design and procedure. Twenty-four experimental items were tested in four conditions: referent animacy (animate vs. inanimate) x competitor animacy (animate vs. inanimate). For each Experiment, 36 participants were randomly assigned to four lists, each of which consisted of six items from each condition, together with 51 filler items. The items occurred in a fixed random order with at least one filler between experimental items. The procedure was the same as in Experiment 1b.

Scoring and analyses. The scoring was the same as in Experiment 1. In total, 4% of all responses (N = 76) were excluded because participants did not follow the arrow (N = 20), a participant started a subordinate clause in their completion ("*as they were lawful documents*" (N = 2), participants used non-target expressions such

as singular noun phrases (N = 25), singular pronouns (N = 16), indefinite noun phrases (N = 11) or dropped the subject noun phrase (N = 2).

Results

Figure 19 presents the percentages of pronoun responses (out of all pronoun and repeated noun phrase responses). Experiments 2a and 2b were analysed together. Arcsine transformed proportions of pronoun responses were submitted to ANOVAs with referent animacy (animate vs. inanimate) and competitor animacy (animate vs. inanimate) as within-participants and -items variables, antecedent position (NP1 vs. NP2) as a between-participants and a within-items variable, and participant/item list (I-IV) as a between-participants and -items variable.

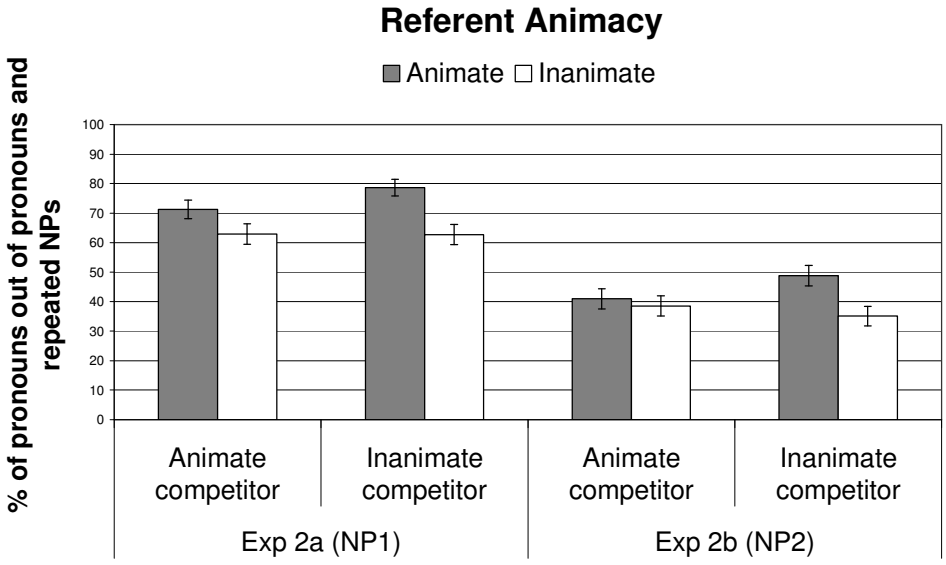

Figure 19. *Percentages of pronouns out of all pronouns and repeated NPs by referent and competitor animacy (Experiment 2). Bars represent standard errors.*

There was a main effect of referent animacy, $F1(1, 64) = 28.87$, $p < .001$, $\eta_p^2 = .311$; $F2(1, 20) = 14.71$, $p = .001$, $\eta_p^2 = .424$, with more pronouns for animate (60%) than inanimate referents (50%). There was no main effect of competitor animacy, $F1(1, 64) = 1.97$, $p = .165$, $\eta_p^2 = .030$; $F2(1, 20) = 3.17$, $p = .090$, $\eta_p^2 = .137$. The main effect of antecedent position was significant, $F1(1, 64) = 13.88$, $p < .001$, $\eta_p^2 = .178$; $F2(1, 20) = 160.59$, $p < .001$, $\eta_p^2 = .889$, with more pronouns for NP1 (69%) than NP2 (41%). There was a significant interaction between referent animacy and competitor animacy, $F1(1, 64) = 7.59$, $p = .008$, $\eta_p^2 = .106$; $F2 (1, 20) = 7.58$, $p = .012$, $\eta_p^2 = .275$: Participants produced fewer pronouns when the two entities had the same animacy (53%) than otherwise (57%). Simple effects showed that the interaction occurred primarily because when the referent was animate, the effect of competitor animacy was significant, with fewer pronouns after an animate (56%) than inanimate competitor (64%), $F1(1, 64) = 7.20$, $p = .009$, $\eta_p^2 = .101$; $F2 (1, 20) = 15.37$, $p = .001$, $\eta_p^2 = .435$, but when the referent was inanimate, there was no significant competitor animacy effect (animate competitor 51%, inanimate competitor 49%), $F1(1, 64) = 1.09$, $p = .301$, $\eta_p^2 = .017$; $F2 < 1$. Neither the referent animacy effect, $F1(1, 64) = 1.70$, $p = .198$, $\eta_p^2 = .026$; $F2 < 1$, nor the competitor animacy effect, $Fs < 1$, interacted with antecedent position. There was also no referent animacy x competitor animacy x antecedent position interaction, $Fs < 1$. See Appendix 9 for the results from logit mixed-effects modelling.

Discussion

The referent's animacy affected the choice of expression when the competitor's animacy was counterbalanced, with more pronouns (relative to repeated noun phrases) for animates than inanimates. In contrast, the competitor's animacy

did not have an independent effect on the choice of expressions when the referent's animacy was counterbalanced. The results thus indicated that the choice of referring expressions is unaffected by the referent's salience relative to the competitor's. This is consistent with the idea that discourse representations are not actively maintained in capacity-constrained focal attention; if they were, we would have expected that the competitor had an independent effect on the frequency of pronouns: The more salient the competitor, the less accessible the referent was, leading to fewer pronouns.

However, animacy congruency of the referent and competitor did have an effect: Overall, pronouns were less frequent when the referent and the competitor had the same animacy rather than otherwise, though the effect was mainly due to the fact that participants produced fewer pronouns when the referent and competitor were both animate than when only the referent was animate. This is in line with Arnold and Griffin (2007), who proposed that gender congruence between two human entities causes semantic interference, making the referent less accessible. They argued that English speakers use fewer pronouns when the referent and competitor have the same gender than when their gender is different (e.g., Arnold & Griffin, 2007; Fukumura et al., 2010) because two persons of the same gender are semantically more similar than two persons of a different gender. Similarly, two entities are semantically more similar when they are both animate compared to when one is animate and the other inanimate, which explains why pronouns are less frequent when both the referent and competitor were animate than when the referent was animate and the competitor inanimate. Interestingly, however, no such animacy congruency effect was observed with inanimate referents. One possibility is that because inanimate entities were not very saliently represented in memory, the

overlapping conceptual features between the inanimate referent - inanimate competitor pairs were not salient enough to significantly reduce pronoun use compared to the inanimate referent - animate competitor pairs.

There is an alternative explanation to the results from Experiment 2 and Arnold and Griffin (2007), however: Pronouns were less frequent in the same gender competitor than the different gender competitor condition in Arnold and Griffin (2007) in English, because a pronoun is ambiguous in a context with a same gender competitor, but not in a context with a different gender competitor. Participants may have avoided pronouns in the same gender condition because they avoided referential ambiguity. Similarly, the animacy congruency effect that occurred in the animate referent conditions in Experiment 2 may have been related to ambiguity avoidance. Because both the referent and competitor were plural in Experiment 2, the pronoun *they* could refer to both and was hence ambiguous. Ferreira, et al., (2005) have shown that language users are more sensitive to the ambiguity of a referring expression when the referent and competitor have a similar meaning, and are therefore more likely to avoid ambiguous expressions. Thus, the animacy congruency effect may have occurred because participants were more sensitive to the ambiguity of *they* when the referent and competitor had the same animacy (and were therefore similar in meaning) than when they had a different animacy. One of the aims of Experiments 3 was to test this alternative explanation.

Experiment 3

Experiments 1 and 2 showed that the referent's animacy affects the choice of referring expression, when the use of the pronoun *they* is ambiguous. One possibility

is that when pronouns are ambiguous, the referent's animacy may affect the use of pronouns, because people may use the referent's animacy as a cue for disambiguation. That is, people may assume that they avoid ambiguity by using pronouns for animates and repeated noun phrases for inanimates. Experiment 3 therefore investigated whether animacy affects the choice of a pronoun and a repeated noun phrase when the pronoun is unambiguous and uniquely identifies the referent.

Another issue that has arisen from Experiment 2 is whether the choice of referring expression is sensitive to semantic interference. In Experiment 2, pronouns for animate referents were less frequent when the competitor's animacy was the same than when the competitor's animacy was different. When both the referent and competitor were animate, the discourse contained two entities that were highly salient and shared similar meanings, which may have caused interference, making the referent's representation less distinct and therefore harder to retrieve. Another possibility is that the effect was driven by ambiguity avoidance: Participants were more likely to avoid the ambiguous pronoun *they* when the referent and competitor had the same animacy than when they had a different animacy, because they may have been more likely to detect the ambiguity when the referent and competitor had similar meanings. Thus, the semantic interference account predicts that the effect of animacy congruency is not limited to cases where pronouns are ambiguous, whereas the ambiguity avoidance account predicts that it is.

Therefore, Experiment 3 investigated the role of animacy in conditions, where the use of a pronoun was unambiguous: The competitor was a singular noun phrase and hence could not be the referent of the pronoun *they*. In Experiment 3a, participants had to refer to NP1 in the first sentence (*the rowers*/*the boats* in 4) while

NP2 (the competitor) was made singular (*the swimmer/ the yacht*). In Experiment 3b, they had to refer to NP2 (*the swimmers/the yachts* in 4) while NP1 was made singular (*the rower/the boat*).

Method

Participants. Seventy-two new participants from the same population as in the previous experiments took part (36 each for Experiments 3a and 3b). Data from one participant who produced more than 25% invalid responses were replaced by another participant (see below for scoring criteria).

Items. I used the same 24 items as in Experiments 2, except for the following changes. In Experiment 3a (NP1 reference), I changed the number of NP2 to singular. I had to replace one item, where changing the number of NP2 resulted in a somewhat implausible sentence (*The rafts carried the mountaineer a long way downstream*). In Experiment 3b (NP2 reference), I had to replace one item because changing the number of NP1 resulted in an implausible sentence (e.g., *The outlaw/tent surrounded the hunters during the night*). In addition, minor modifications had to be made to three items by changing NP1 or the verb in order to make the sentences plausible. See Appendix. The filler items in Experiments 3a and 3b were exactly the same as in Experiments 2a and 2b respectively.

Design, procedure, scoring and analyses. These were the same as before. In total, 5% of all responses (N = 90) were excluded because participants did not follow the arrow (N = 14); the referent was not the subject in the completions (N = 6); non-target expressions such as singular noun phrases (N = 31), singular pronouns (N =19), indefinite noun phrases (N = 9), demonstrative expressions (N = 6) or *none*

of them (N =1) were used; or participants dropped the subject (N = 1) or produced subordinate clause continuations (N =3).

Results

Figure 20 presents the percentages of pronouns for Experiment 3. Experiments 3a and 3b were analysed together. ANOVAs were conducted in the same way as in Experiment 2.

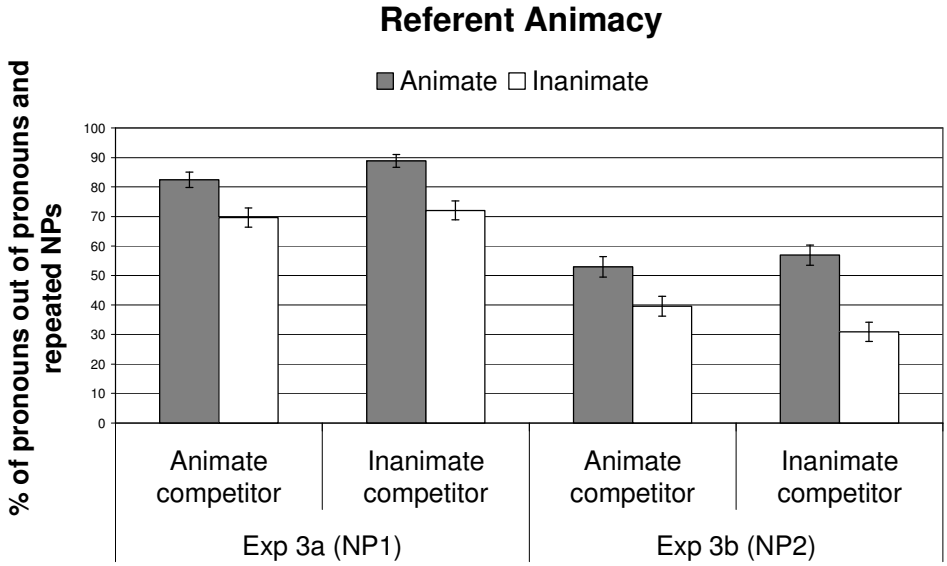

Figure 20. *Percentages of pronouns out of all pronouns and repeated NPs by referent and competitor animacy (Experiment 3). Bars represent standard errors.*

There was a main effect of referent animacy, $F1(1, 64) = 47.92$, $p < .001$, $\eta_p^2 = .428$; $F2(1, 20) = 57.49$, $p < .001$, $\eta_p^2 = .742$, indicating more pronouns in the animate (70%) than inanimate referent (53%) conditions. There was no main effect of competitor animacy, $Fs < 1$. The main effect of antecedent position was significant, $F1(1, 64) = 21.02$, $p < .001$, $\eta_p^2 = .247$; $F2(1, 20) = 238.76$, $p < .001$, $\eta_p^2 = .923$, with more pronouns for NP1 (78%) than NP2 (45%). There was a significant

interaction between referent animacy and competitor animacy, $F1(1, 64) = 6.05$, $p = .017$, $\eta_p^2 = .086$; $F2(1, 20) = 8.34$, $p = .009$, $\eta_p^2 = .294$, which indicated that the effect of referent animacy was affected by whether the competitor was animate or inanimate; in other words, pronouns were less frequent when the competitor's animacy was congruent with the referent's animacy (60%) than when it was not (64%). Simple effects showed that this interaction was mainly due to the animate referent conditions: When the referent was animate, pronoun use was significantly lower following animate (68%) than inanimate (73%) competitors, $F1(1, 64) = 4.05$, $p = .048$ $\eta_p^2 = .059$; $F2(1, 20) = 6.18$, $p = .022$, $\eta_p^2 = .236$, whereas the effect of animacy congruence did not reach significance with inanimate referents (animate competitor 55%, inanimate competitor 51%), $F1(1, 64) = 1.28$, $p = .262$ $\eta_p^2 = .020$; $F2(1, 20) = 2.05$, $p = .168$, $\eta_p^2 = .093$. Referent animacy did not interact with antecedent position, $F1(1, 64) = 1.17$, $p = .283$, $\eta_p^2 = .018$; $F2 < 1$. The interaction between competitor animacy and antecedent position was significant by items, but not by participants; $F1(1, 64) = 2.71$, $p = .105$, $\eta_p^2 = .041$; $F2(1, 20) = 5.56$, $p = .029$, $\eta_p^2 = .218$. In the NP1 reference conditions, participants had a tendency to produce slightly fewer pronouns when the competitor was animate (76%) than inanimate (80%), but this effect was only significant by items, $F1(1, 32) = 2.35$, $p = .135$, $\eta_p^2 = .068$, $F2(1, 20) = 5.98$, $p = .024$, $\eta_p^2 = .230$, whereas in the NP2 reference condition, the difference was non-significant and in the opposite direction, with slightly more pronouns after animate competitors (46%) than inanimate competitors (44%), $F1 < 1$; $F2(1, 20) = 1.10$, $p = .307$, $\eta_p^2 = .054$. There was no referent animacy x competitor animacy x antecedent position interaction, $F1(1, 64) = 1.47$, $p = .230$, $\eta_p^2 = .022$; $F2(1, 20) = 1.84$, $p = .190$, $\eta_p^2 = .084$. See Appendix 9 for the results from logit mixed-effects analyses.

In addition, I carried out combined analyses of Experiments 2 and 3 by adding ambiguity (ambiguous/Experiment 2 vs. unambiguous/Experiment 3) as a between participants and within-items variable. More pronouns were produced for animate (65%) than inanimate (51%) referents, $F1(1, 128) = 76.73$, $p < .001$, $\eta_p^2 = .375$; $F2(1, 20) = 52.71$, $p < .001$, $\eta_p^2 = .725$. In contrast, there was no main effect of competitor animacy, $F1(1, 128) = 2.03$, $p = .157$, $\eta_p^2 = .016$; $F2(1, 20) = 2.32$, $p = .143$, $\eta_p^2 = .104$. Furthermore, more pronouns were produced for NP1 (74%) than NP2 (43%), $F1(1, 128) = 34.25$, $p < .001$, $\eta_p^2 = .211$; $F2(1, 20) = 305.62$, $p < .001$, $\eta_p^2 = .939$, and there was a tendency for more pronouns when they were unambiguous (62%) than ambiguous (55%), though this was only significant by items, $F1(1, 128) = 1.33$, $p = .250$, $\eta_p^2 = .010$; $F2(1, 20) = 34.00$, $p < .001$, $\eta_p^2 = .630$. The referent animacy x competitor animacy interaction was significant, $F1(1, 128) = 13.51$, $p < .001$, $\eta_p^2 = .095$, $F2(1, 20) = 11.26$, $p = .003$, $\eta_p^2 = .360$: Overall, pronouns were less frequent when the entities had the same animacy (56%) than otherwise (61%). Simple effects showed that this congruency effect was mainly due to the conditions with animate referents, $F1(1, 128) = 10.79$, $p = .001$, $\eta_p^2 = .078$; $F2(1, 20) = 14.99$, $p = .001$, $\eta_p^2 = .428$, and did not reach significance with inanimate referents, $F1(1, 128) = 2.36$, $p = .127$, $\eta_p^2 = .018$; $F2(1, 20) = 1.45$, $p = .242$, $\eta_p^2 = .068$. The effect of referent animacy also interacted with ambiguity, $F1(1, 128) = 5.76$, $p = .018$, $\eta_p^2 = .043$; $F2(1, 20) = 4.91$, $p = .039$, $\eta_p^2 = .197$, with a larger referent animacy effect in the unambiguous (34%) than the ambiguous (20%) conditions. The effect of antecedent position interacted with ambiguity, $F1(1, 128) = 5.76$, $p = .018$, $\eta_p^2 = .043$; $F2(1, 20) = 3.88$, $p = .063$, $\eta_p^2 = .162$, with a larger antecedent position effect in the unambiguous (33%) than ambiguous conditions (28%). No other interactions were significant (all *p*s > .05).

Discussion

Participants used more pronouns when the referent was animate than inanimate even though pronouns were unambiguous. In fact, referent animacy had a larger effect in Experiment 3 (34%) than Experiment 2 (20%), where pronouns were ambiguous. Similarly, the effect of antecedent position was also larger in Experiment 3 (33%) than Experiment 2 (28%), suggesting that when the two entities were congruent in number and the use of a pronoun was ambiguous, the referent's properties (its animacy and its antecedent position) had a relatively smaller effect on the choice of expressions. Most important, this result suggests that the referent animacy effect was not driven by ambiguity avoidance, because it occurred even when pronouns were unambiguous. Experiment 3 also showed an effect of animacy congruence: Overall, pronouns were less frequent when the referent and the competitor had the same animacy than otherwise, though the effect of animacy congruency significantly reduced pronoun use when the referent and the competitor were both animate (relative to when only the referent was animate), but not when the referent and the competitor were both inanimate (relative to when only the referent was inanimate). Because the pronoun's number ruled out reference to the competitor in Experiment 3, the findings of Experiment 3 suggest that two entities that are semantically similar interfere, and therefore reduce the referent's accessibility. However, as in Experiment 2, no significant competition was found when the referent and the competitor were both inanimate, suggesting that semantic interference is negligible when the competitor is inanimate, and therefore low in accessibility. Arnold and Griffin (2007) previously argued for semantic interference, but their evidence was based on the gender congruency effect, which can also be explained in terms of ambiguity avoidance. The results rule out the ambiguity avoidance account and

therefore provide the first evidence that semantic interference affects the use of pronouns over repeated noun phrases.

There was no evidence that the animacy of the competitor had an independent effect, when referent animacy was counterbalanced, except that when participants referred to NP1, there was a slight tendency for fewer pronouns following an animate than inanimate competitor. However, this effect did not generalise across participants and did not occur when participants referred to NP2. If the competitor animacy effect had been a real effect, I would have expected it to be stronger when the competitor was NP1 than NP2 (and the referent was NP2 rather than NP1). Its grammatical role and position make NP1 more accessible than NP2, so the competitor should have affected the referent's accessibility more when it was NP1, but the results from the NP2 reference conditions did not bear this out.

Finally, compared to Experiment 2 (55%), pronoun use was slightly more frequent in Experiment 3 (62%), presumably because pronouns were unambiguous in Experiment 3. However, the overall pattern of the results was very similar to that in Experiment 2.

General Discussion

The aim of the current study was to investigate whether and how inherent semantic properties of the referent affect the choice of pronouns and repeated noun phrases. I did this by investigating the effects of animacy. Previous evidence from corpus analyses is unclear as to whether the animacy of the referent has an effect on the choice of referring expression if discourse factors that correlate with the referent's animacy such as its grammatical role (Clark & Begun, 1971; Itagaki & Prideaux,

1985; Pearson et al. 2001) and its frequency of mention in the prior discourse (Givón, 1983a) are controlled for. Using both a free and a constrained completion method, Experiment 1 showed that when these factors are controlled, participants produced more pronouns relative to repeated noun phrases to refer to animate than inanimate entities. In addition, participants produced more pronouns when referring to the first-mentioned subject than the second-mentioned object in the preceding sentence, consistent with previous studies (Arnold, 2001; Fukumura & Van Gompel, 2010; Stevenson et al., 1994). The results from Experiments 2-3 showed that while participants produced more pronouns for animate than inanimate referents when the competitor's animacy was counterbalanced, the animacy of the competitor had no independent main effect when the referent's animacy was counterbalanced. There was only one tendency for a main effect of competitor animacy, which occurred in Experiment 3a, but the effect did not generalise across participants. Furthermore, in Experiment 3b, where the competitor was NP1 and was therefore more accessible than in Experiment 3a (where it was NP2), participants did not produce fewer pronouns when the competitor was animate than inanimate when referent animacy was counterbalanced. Overall, there was no evidence for an independent effect of competitor animacy on the choice of pronouns and repeated noun phrases. One possible reason for this is that language users do not actively maintain discourse entities in a capacity-constrained manner (Foraker & McElree, 2007). Foraker and McElree (2007) argued that instead, "all representations are passively stored in memory, in the sense that a retrieval process must be used to restore the item to current awareness for ongoing processing" (p. 359). In contrast to focal attention (Foraker & McElree, 2007) or working memory (Baddeley, 1986; Just & Carpenter,

1992), passive storage in memory is not capacity constrained, so a highly accessible competitor does not reduce the accessibility of the referent.

Interestingly, however, whether the referent and competitor were the same or different in animacy did affect the choice of referring expression. When referring to animate entities, pronouns were less frequent (therefore, there were more repeated noun phrases) when the competitor was also animate rather than inanimate, suggesting that when the referent is animate, congruency with the competitor's animacy causes interference. In contrast, both Experiments 2 and 3 showed that when the referent was inanimate, congruency with the competitor's animacy did not significantly affect the frequency of pronouns. This suggests that because the competitor was inanimate and hence less accessible, it did not sufficiently interfere during reference production.

Semantic interference also explains findings that might seem inconsistent with the argument that the accessibility of a competitor does not affect choice of referring expression. Arnold and Griffin (2007) observed fewer pronouns when the preceding linguistic context mentioned an additional character (competitor) than when it did not, and similarly, Fukumura et al. (2010) found that pronouns were less frequent when the visual context contained a competitor than when it did not. One explanation of these results is that the accessibility of the competitor (due to its linguistic or visual presence) affects the choice of referring expression. However, we can also interpret the effects in terms of semantic interference by assuming that the linguistic or visual presence of a competitor that shares at least some semantic properties with the referent makes the referent less accessible. In particular, in Arnold and Griffin (2007) and Fukumura et al. (2010), both the referent and the competitor were persons, so they were semantically very similar. This should result

in strong semantic interference, and therefore reduce the frequency of pronoun use, consistent with their findings.

As mentioned in the Introduction, one possibility is that the choice of expression is affected by the accessibility of the referent's predicate. Language producers may choose longer referring expressions to refer to inanimate than animate entities, because accessing the predicate of inanimate entities may take longer than that of animate entities. Using a repeated noun phrase would allow them to delay the production of the predicate, whereas they can quickly produce the predicate following a pronoun. Predicate accessibility might also explain the semantic interference effect. When the competitor had the same animacy as the referent, it was semantically compatible with the predicate for the referent, and this may have made the predicate less accessible. To buy more time to prepare the production of the inaccessible predicate, participants may have used repeated noun phrases. In contrast, when the competitor did not interfere, the predicate was more accessible and easier to produce, so they used pronouns that allowed them to produce the predicate more quickly.

In Chapter 4, we have observed that the competitor's compatibility with the predicate affects the choice of referring expression. When participants described a referent's action (e.g., a cowboy taking off his hat), they were less likely to produce a pronoun (rather than a noun phrase) when the competitor was in a similar situation. For example, they were less likely to say *he took off his hat* (rather than *the cowboy took off his hat*) when both the referent (the cowboy) and the competitor (a gentleman) were sitting on a horse than when only the referent was sitting on a horse. One possible explanation for this is that when the referent and the competitor both afford the same predicate (getting of a horse), the predicate becomes harder to

produce and hence people use more elaborate expressions to delay the production of the predicate.

However, the results from Fukumura and Van Gompel (2010) suggest that the predicate accessibility account is unlikely. Following *John scared Mary because*…., people were more likely to refer to John as the subject in the second clause, because it is easier for language users to come up with a predicate that attributes the cause of the event to NP1 (e.g., ... *John was shouting aloud*) than NP2. In contrast, when the verb was replaced with *fear*, people were more likely to refer to Mary (e.g., ... *Mary was shouting aloud*), because the verb *fear* biases causality assignment to NP2. In other words, the predicate for NP1 was more accessible following *scare* than *fear*, whereas the predicate for NP2 was more accessible following *fear* than *scare*. However, the causality bias had no effect on the choice of pronouns and repeated names: Pronouns were no more frequent when the predicate associated with the referent was highly accessible (the predicate for NP1 following *scare* rather than *fear*, the predicate for NP2 following *fear* than *scare*) than when it was not. This suggests that the choice of pronouns and repeated names is not affected by the accessibility of the predicate and that the effect of animacy on the choice of pronouns and repeated noun phrases is not due to a higher accessibility of the predicate for animate than inanimate entities.

Although the choice of pronouns and more explicit referring expressions may not be affected by the accessibility of the predicate, the inherently higher predicability of animates compared to inanimates may make animates conceptually more accessible than inanimates (Bock & Warren, 1985), and this may explain why pronouns are more frequent for animates than inanimates. Furthermore, the reason why the competitor's similarity to the referent has an effect may be because when

the competitor is semantically similar to the referent, it is also compatible with the predicate for the referent. This may also reduce the referent' conceptual accessibility, as in Chapter 4, which showed fewer pronouns (and therefore more repeated noun phrases) when the competitor's affordances were compatible with the referent's to-be-described action than otherwise, because when referring, language users may activate the referent's conceptual information in relation to the information that is predicated of it. That is, both referent animacy and animacy congruency may have an effect because they influence the referent's conceptual accessibility.

When language producers refer, they need to encode the conceptual representation of the referent (e.g., Bock & Levelt, 1994; Levelt, 1989). I propose that the choice of referring expressions is driven by the amount of conceptual information about the referent that language producers have to encode in order to refer to it. Presumably, how much conceptual encoding is needed is affected by the salience or richness of the referent's conceptual representation in memory. When referring, language users need to encode very little conceptual information about the referent when its conceptual information is already clearly represented in memory, whereas they need to encode more information about it when it is not salient. The amount of conceptual information that needs to be encoded may be reflected in the choice of referring expression: The more conceptual encoding is necessary (i.e., the less accessible the referent), the more conceptual information is expressed in the referring expression. Thus, when the referent is inanimate and therefore low conceptually accessible, people use more explicit referring expressions than when the referent is animate and high in accessibility. Similarly, they encode more conceptual information about an animate referent when the context contains an

animate competitor than when the competitor has a different animacy, resulting in a reduction in pronoun use (and increase in repeated noun phrases).

In sum, the results showed that language users produced more pronouns (relative to repeated noun phrases) for animate than inanimate entities during anaphoric reference. In contrast, the animacy of a competitor entity did not have an independent effect, indicating that the choice of referring expression is not determined by how accessible the referent is relative to the competitor. Finally, when referring to animates, fewer pronouns were produced when the competitor was also animate than otherwise, indicating that animacy congruency between the two entities caused semantic interference, reducing the referent's accessibility.

General Discussion

As reviewed in Chapters 1 and 2, studies on reference have been led by two very different research traditions; one which has focused primarily upon the antecedent's properties in the prior linguistic context, ignoring non-linguistic, pragmatic variables, and one which has focused on the speaker's use of non-linguistic, pragmatic information, often in the absence of the prior linguistic context. Normal conversations, however, proceed in environments where various sources of information are available. In order to fully understand how people choose referring expressions in naturalistic circumstances, we need to bridge the gap between the two research traditions by investigating how speakers use different sources of information. One of the major aims of this thesis was to make contributions to such an enterprise by investigating how non-linguistic variables influence anaphoric reference by adapting a referential communication task (Krauss & Weinheimer, 1964; 1966) such that both linguistic and non-linguistic variables can simultaneously be considered in a naturalistic and yet controlled environment. This chapter summarises the major findings from the thesis and discusses their implications for models of reference production and future investigation.

Competition is the key for understanding reference choice

Accessibility theories (Ariel, 1990; Givón, 1983) posit competition as one of the major factors that constrain the choice of referring expressions. Early

psycholinguistic research has shown that as the number of characters mentioned in the intervening material increases, fewer pronouns are produced (Clancy, 1980) and pronouns are less frequent when the prior linguistic context mentions a same-gender competitor than otherwise (Fletcher, 1985). More recently, Arnold and Griffin (2007) found that even when the competitor had a different gender from the referent, its mention in the prior context reduced pronoun use, suggesting that the mention of a referential competitor reduces the referent's accessibility and hence the use of pronouns relative to more explicit referring expressions. What is particularly striking about the results of Arnold and Griffin is that the visual presence of a referential competitor had no effect on the choice of pronouns and repeated names, suggesting that the referent's accessibility is determined by the prior linguistic context and non-linguistic information plays no role during anaphoric reference.

However, using a referential communication task and a stronger visual manipulation than Arnold and Griffin had used, the results reported in Chapter 4 showed (Experiment 1) that the visual presence of a same-gender competitor significantly reduced the frequency of pronouns (relative to repeated noun phrases), even when the competitor was not explicitly mentioned in the prior context, suggesting that discourse representations also consist of non-linguistic information. The results from Experiment 2 showed that the effect of the visual competitor was not limited to cases where pronouns were ambiguous: Pronouns were less frequent when a different gender competitor was present in the visual context than when it was absent, suggesting that the presence of a competitor makes the referent's representation less accessible in memory and therefore reduces the likelihood of pronoun usage.

Similarity-based interference is the driving force

One possible explanation for the effect of competitor presence in the visual context is that the competitor is more salient when it is present rather than absent in the visual context, so the referent's accessibility relative to the competitor is lower in the competitor present condition than in the competitor absent condition. That is, the choice of pronouns and repeated noun phrases is affected by the referent's accessibility relative to the competitor (the relative accessibility account). This makes sense if we assume that pronoun usage is constrained by the referent's representation in focal attention (e.g., Gundel et al., 1993) such that a highly prominent referential competitor reduces the referent's level of activation and the likelihood of pronominalisation. Alternatively, it is also possible that the presence of a competitor in the visual context reduces the referent's accessibility because even though the competitor had a different gender from the referent, it shared other semantic features such as humannness, and the competitor's semantic similarity or semantic compatibility with the referent made it difficult to activate the referent's representation (the similarity-based interference account).

Evidence against the relative accessibility account comes from the results of Chapter 6 (animacy), which suggested that the choice of referring expression is not affected by the referent's accessibility relative to a competitor. When the competitor animacy is held constant, participants used more pronouns (therefore, fewer definite noun phrases) when the referent was animate than inanimate. In contrast, there was no independent effect of competitor animacy on pronoun usage when the referent animacy was held constant. Participants did not produce any fewer pronouns when the competitor was animate compared to when it was inanimate. That is, there was

no evidence that pronouns were less frequent when the competitor was highly salient, suggesting that the choice of referring expression is not affected by how salient or accessible the referent is relative to the competitor. This is inconsistent with the idea that language users actively maintain discourse entities in focal attention, because when the activation of one entity increases, the activation of another entity should go down such that the total activation of the discourse entities is capacity-constrained. Instead, the results suggest that all the discourse representations are stored in passive memory such that they need to be retrieved from memory for any linguistic process to proceed but they can differ depending on the distinctiveness or salience of their representations (Foraker & McElree, 2007).

The results of Chapter 6 further suggested that the competitor affects the referent's accessibility via similarity-based interference. Pronouns were less frequent when the referent and the competitor were both animate than when when the referent was animate but the competitor was not. This animacy congruency effect was observed both when pronouns were ambiguous and when they were unambiguous, suggesting that the effect was not due to ambiguity avoidance but due to a general cognitive constraint that makes the memory retrieval of the referent's representation harder when another entity that is highly similar to the referent is represented in memory. The animacy congruency effect did not occur when the referent and the competitor were both inanimate, suggesting that the presence of a similar competitor does not cause interference if its representation is inanimate and not very accesible.

Studies on affordances reported in Chapter 5 suggested that interference does not only result from entities' similarity with respect to their identities or linguistic labels. Interference could also be caused by entities' similarity in extrinsic properties. When describing an action carried out by a referent (e.g., *The king gets*

off a horse or *He gets off a horse*), speakers reduced pronoun usage when the competitor in the visual context was in the same situation as the referent (sitting on a horse) compared to when it was in a different situation (standing), suggesting that the choice of referring expression is affected by the entities' situation-specific properties (Experiment 1). In Experiment 2, the situational similarity had an effect even when it was unrelated to the competitor's compatibility with the description of the target action. Participants produced fewer pronouns when the competitor was in the same situation as the referent than otherwise even though in both conditions, the competitor always afforded the target action, suggesting that perceptual similarity between the two entities caused interference. However, the effect of situation was larger when the competitor afforded the target action, indicating that when the competitor is compatible with the to-be-expressed message, it causes additional interference.

These findings suggest that the competitor's visual presence reduced pronoun usage (Chapter 3), not necessarily because its presence reduced the referent's relative salience in the visual context, but because it caused semantic interference. In Chapter 3, the referent and the competitor were always human animate and the competitor was mostly compatible with the action that was predicated of the referent. Therefore, when the competitor was present in the visual context, there were two semantically compatible entities, whereas when the competitor was absent in the visual context, no other semantically compatible entity was present. It may be that the effect of the competitor's visual context was driven by similarity-based interference. This predicts that the presence or absence of an inanimate object in the referential context may not have the same kind of impact on the choice of referring expressions for human

referents, because the inanimate competitor is dissimilar to a human referent and it does not afford the same kind of action as the referent.

Interference and ambiguity avoidance

Arnold and Griffin (2007) suggested that the effect of gender ambiguity on pronoun usage in English may be due to competition: A same gender competitor competes more strongly than a different gender competitor because a same gender competitor is semantically more similar to a different gender competitor and its presence in the context reduces the referent's accessibility and thus the frequency of pronouns. Whether and the extent to which the effect of gender on the choice of referring expression is due to competition or ambiguity avoidance is harder to test, because semantic similarity and ambiguity are confounded. My recent finding from a study conducted in Finnish, however, suggests that congruence in biological gender indeed causes semantic competition (see Appendix 10 for further details). Finnish is a non-gender marked language, because gender is not encoded on pronouns (hän for "he" and "she") and hence gender cannot influence the ambiguity of referring expressions. Nevertheless, participants were less likely to use pronouns when the competitor had the same biological gender as the referent than when its biological gender was different. If the effect of gender was limited to conditions where gender determines the ambiguity of a pronoun, that is, the effect of gender is exclusively motivated by ambiguity avoidance, we would not expect to see an effect of gender on Finnish pronouns.

We need not conclude that the effect of gender on English pronouns is unaffected by ambiguity avoidance, however, because semantic interference and

ambiguity avoidance could both contribute to the choice of expression. That is, English speakers may be sensitive to the gender ambiguity of the pronoun but they may primarily use semantic interference as a cue for avoiding it. When the competitor has the same gender as the referent, the referent's representation gets harder to retrieve, which may trigger the processor to recognise the gender congruence between the two entities and the ambiguity of using a pronoun in that context. As shown in Chapter 5 (Affordances, Exp 1), after having produced a pronoun, participants occasionally replaced it with a definite noun phrase, but such repairs were only observed when the pronoun was gender ambiguous. Given that semantic interference modulates the referent's accessibility during conceptual encoding, it cannot account for such repair processes that occurred following articulation. Therefore, it is most likely that English speakers are sensitive to the ambiguity of the pronoun at some level such that when semantic interference has failed to inhibit the production of gender ambiguous pronouns, speakers can still avoid pronouns during later stages of production.

According to Ferreira et al.'s model (2005) of ambiguity avoidance, ambiguity can be avoided fairly easily when the ambiguity can be recognised on the basis of conceptual representations rather than on the basis of linguistic representations. Perhaps English speakers are sensitive to the gender ambiguity of pronouns, because ambiguity can be determined by whether the competitor has the same biological gender as the referent, which should be obvious from the entities' identities. In many other European languages that have grammatical gender marking like Italian or German, if the referent is animate, its biological gender normally determines the form of a pronoun (as in English). Therefore, when the competitor is also animate, avoiding gender ambiguous pronouns should be as easy as in English,

because speakers can determine the ambiguity of a pronoun on the basis of the entities' conceptual representations. However, if the referent is inanimate, the form of a pronoun is determined by its grammatical gender. But speakers cannot determine an entity's grammatical gender unless they retrieve the syntactic properties of the word that denotes it. Therefore, avoiding gender ambiguous pronouns should be harder if the competitor is inanimate rather than when it is animate.

Semantic interference interacts with other factors

The magnitude of semantic interference appears to be constrained by the referent's accessibility. The effect of visual competitor tended to be smaller when the competitor was not mentioned in the linguistic context compared to when it was. Similarly, the effect of gender congruence was smaller (in fact, the effect was only marginal by participants) when the competitor was absent rather than present in the visual context. This is consistent with Arnold et al. (2000), who found an effect of gender congruence only when the referent was mentioned as the second-mentioned object but not when it was the first-mentioned subject. As many researchers argue (e.g., Arnold, 2001; Brennan, 1995; Fukumura & Van Gompel, 2010; Gernsbacher & Hargreaves, 1988; Gordon et al., 1993; Stevenson et al., 1994), the first-mentioned subject is more accessible than the second-mentioned subject, so whether interference due to gender congruence affects the choice of referring expression seems to be dependent on how salient the referent's representation is.

One possible reason why the competitor's presence in the visual context had a weaker impact when there was no competitor mentioned in the linguistic context is

because, regardless of whether the competitor was present in the visual context, the referent's conceptual representation was already highly activated in the speaker's message representation in the condition where there was no competitor in the linguistic context. Interestingly, the competitor's affordances in the referential context did not interact with gender congruency, however. Experiment 1 in Chapter 4 (Affordances) showed that the effect of affordances (or situational congruence) did not interact with whether the competitor had the same or a different gender from the referent. In this experiment, the competitor was always mentioned in the prior linguistic context and was present in the visual context, so perhaps the referent was not very accessible in the speaker's discourse model. As a result, regardless of whether the referent and the competitor had the same or different gender, situational similarity had a significant impact on the referent's accessibility. When the competitor was in a different situation from the referent, the referent's representation was more easily retrieved from memory, presumably because of the referent's higher distinctiveness, than when the competitor was in the same situation. As a result, in both gender conditions, the referent was more accessible when the competitor was in a different than in the same situation in the speaker's message representation.

Egocentric versus allocentric?

The results from Chapter 5 suggested that the effect of accessibility does not arise from the speaker's audience design to the addressee. The chapter addressed the much debated issue of whether and to what extent language production is affected by the addressee's needs. Theories of reference assume that speakers choose specific referential forms (e.g., pronouns, definite noun phrases) depending on how salient

they assume the referent is in the addressee's discourse model (Ariel, 1990; Chafe, 1994; Givón, 1983). When the referent is assumed to be low in salience in the addressee's model, speakers produce more explicit referring expressions. By manipulating whether the addressee heard an earlier reference to the competitor, two experiments examined if speakers take into account whether the referent is salient in the addressee's discourse model. Pronouns were less frequent (therefore, definite noun phrases were more frequent) when speakers themselves heard reference to a referential competitor (rather than the referent) in the immediately preceding sentence. Crucially, such an effect of competition was not modulated by whether the addressee heard that sentence, suggesting that whether the preceding sentence made the referent accessible to the addressee had no effect. This indicated speakers do not adopt their addressee's perspective, but instead use their own model to determine the referent's salience and hence the choice of referring expression: They use more pronouns when the referent is accessible in their own discourse model, without considering how accessible it is to the addressee. The results thus indicated that the effect of accessibility on the choice of referring expression should be explained in terms of a production-internal constraint rather than the Gricean cooperative principle.

What is the mechanism that underlies the choice of referring expression?

I assume that the choice of pronouns and repeated noun phrases is determined by the degree of conceptual reactivation that is needed to activate the referent's conceptual representation when speakers decide to refer. When speakers formulate their messages, they retrieve the referent's representation from their discourse model.

When the referent is salient in the discourse, its conceptual representation is clearly or richly represented in the speaker's memory (Foraker & McElree, 2007), so the referent receives a high activation in the speaker's message representation. In contrast, when the referent is less salient in the discourse, its conceptual representation is less clear, so it receives a lower activation in their message representation. When speakers initiate linguistic encoding processes, they then reactivate the referent's conceptual representation. If the referent's conceptual representation is already highly activated in their message representation, speakers need to reactivate very little conceptual information about it, whereas if the referent's conceptual activation is low, speakers need to reactivate more conceptual information. That is, at the beginning of reference production processes, speakers reactivate the referent's representation to a certain threshold. Presumably, this is because speakers may wish to have a strong enough representation about what they are referring to, but they do not reactivate more conceptual information than required, because this takes away resources that could be used for processing other information. Semantically impoverished referring expressions such as pronouns are more likely to be produced when the referent is more prominent in the context, because the more prominent the referent is in the context, the more clearly or strongly represented the referent is in the speaker's message representation, so speakers reactivate very little information about the referent. Similarly, more explicit referring expressions such as definite noun phrases are more frequent when the referent is less prominent in the context, because the prominent referent is less activated in the speaker's message representation. Thus, the choice of referring expression is affected by the degree of conceptual encoding that is needed when speakers initiate linguistic encoding processes following message formulation.

In sum, when the referent's representation is less accessible, speakers tend to produce more explicit referring expressions, not because they try to assist the addressee's comprehension, but because before initiating linguistic encoding, speakers activate more conceptual information about the referent in order for them to have a stronger representation about what they are referring to. Similarly, when the referent is highly accessible, speakers tend to provide less explicit referring expressions such as pronouns, not because they use pronouns to signal the referent's accessibility to the addressee, but because they activate less conceptual information about the referent when the referent is highly salient in memory.

How does this model explain other findings?

The idea that the degree of conceptual encoding affects the choice of expression may also explain findings of some experiments examining the choice of initial (i.e. non-anaphoric) referring expressions. As discussed earlier, Brennan and Clark (1996) showed that when referring to an entity in the visual context with no other shoe, speakers tend to produce basic terms such as *shoe* rather than subordinate terms like *loafer.* When the context contains more than one shoe, however, speakers tend to use subordinate expressions (e.g., *loafer* rather than *shoe*). Brennan and Clark explained this in terms of ambiguity avoidance; in the context of more than one shoe, *shoe* does not specify which shoe speakers intend to refer to, so they produce *loafer* to disambiguate their reference. However, as discussed in Chapter 4 (Affordances) and suggested by Ferreira et al. (2005), speakers may not normally choose referring expressions by computing whether a particular expression is ambiguous. Indeed, the

results of Brennan and Clark suggest that the use of a subordinate term does not always result from ambiguity avoidance. When the entity has been previously mentioned as *loafer*, speakers often repeat the subordinate referring expression even when the basic-term *shoe* is unambiguous. Brennan and Clark attributed this effect of lexical repetition to the speaker's adherence to the *conceptual pact* with the addressee, because lexical repetition was less frequent if the expression or the object was new to the addressee. However, in their study, it was unclear whether such addressee adaptation occurred because of feedback from the addressee, as suggested by Horton and Gerrig (2005a), so it is possible that speakers may initially try to produce referring expressions that are easier to produce.

I therefore argue that speakers' choice of expression is driven by the degree of conceptual information speakers access following message formulation. When referring to an entity for the first time, speakers hardly produce pronouns (Gundel et al., 2005), perhaps because the referent's representation has a low activation in the speaker's message representation, so that they need to access more conceptual information to boost the referent's activation. To increase the referent's activation, speakers do not normally encode more conceptual information than necessary, because encoding an excessive amount of conceptual information would delay production processes. Therefore, when the context does not contain any other conceptually compatible entity, speakers typically produce a basic level term (e.g., *shoe*) rather than subordinate level noun phrases (e.g., *loafer*) (cf. Rosch, Mervis, Gray, Johnson, & Boyesbraem, 1976). However, in a context with more than one entity from the same semantic category, speakers produce subordinate terms, perhaps because the presence of a same-category competitor interferes with conceptual encoding processes: Because the referent's conceptual representation is less

distinguishable from the competitor, speakers cannot access the referent's conceptual representation as effectively as in a situation where the competitor is dissimilar, so speakers encode additional semantic information to increase the activation of the referent's representation. Furthermore, speakers tend to repeat *loafer* even when *shoe* is unambiguous, because by virtue of prior mention, the conceptual or even lexical representation of *loafer* is more accessible than the representation of the basic term, not necessarily because speakers try to be cooperative to their addressee's comprehension.

In relation to the models of language production

How does the account suggested above fit with current models of language production? Most models of word production are concerned with linguistic encoding processes involved in language production, for instance, how speakers select and produce appropriate lexical properties of the word they intend to express (e.g., Caramazza, 1997; Dell, 1986; Dell & O'Seaghdha, 1992; Levelt, Roelofs, & Meyer, 1999; Roelofs, 1992). But much less is known about selection of the *message* or the representation that interfaces between thought and language (Bock, 1982), which is assumed to guide lexical selection. For instance, Levelt et al. (1999) explains how speakers select a syntactic representation (or its *lemma*) of the to-be-expressed word. According to their model, the likelihood with which speakers successfully produce a word such as *horse* is high if its *lemma* is highly activated relative to the activation of all other lemmas that are also activated in the lexical network (e.g., GOAT or ANIMAL). Their model assumes that the activation of a lemma is determined by the level of activation of its *lexical concept* or a conceptual memory node that is

assumed to bear a one-to-one mapping with the corresponding lemma. However, they leave open the question of how speakers choose a particular lexical concept amongst alternatives. Why do speakers conceptualise a horse as HORSE rather than STALLION? Levelt (1999; 2001) argued that this choice is affected by the speaker's assessment of contextual appropriateness or perspective taking - what levels of information the addressee would appreciate in a particular communicative setting, as claimed by Clark and his colleagues. Although other production theories including Dell (1986) and Caramazza (1997) also assume that word production is initiated by conceptual access (though they argue that conceptual information that guides word selection is *featural* rather than holistic), they are equally unclear about what affects the selection of conceptual features that result in the production of a particular word.

As discussed above, one possible way of extending these models of language production is to assume that speakers choose a referring expression depending on how much conceptual encoding is needed for the referent's activation to exceed a certain threshold during conceptualisation. That is, the lower the referent's activation relative to the threshold, the more conceptual information speakers need to access to boost the referent's activation during conceptual planning. As a result, speakers are more likely to produce referring expressions that contain more conceptual information about the referent. This account assumes that when the referent is salient in the linguistic or non-linguistic context or its inherent properties make it conceptually accessible, the referent has a high level of activation when speakers decide to refer. Under such conditions, speakers tend to choose a semantically impoverished expression (such as pronouns) more frequently, because the degree of conceptual encoding that is needed is less compared to when the referent is less salient.

But exactly how does the activation of the referent's conceptual representation determine the choice of a particular referring expression? To account for this, like decompositional production theories (e.g., Caramazza, 1997; Dell, 1986; Dell & O'Seaghdha, 1992; Dell, Schwartz, Martin, Saffran, & Gagnon, 1997), I assume that the input conceptual representation comprises a set of conceptual properties or features that are connected to corresponding lexical representations, either lemmas (Levelt et al., 1999; Dell, 1986; Dell & O'Seaghdha, 1992; Dell, et al., 1997) or lexemes (Caramazza, 1997). Thus, a meaning of a word is *distributed*, in the sense that it comprises a collection of activated memory nodes, representing features of the entity that the word denotes, or features of other entities or events that are conceptually or associatively related to the referent. For instance, the lexical item KING may be connected to features, such as being male, having a crown, or objects or events that are associated with a king's social status. Words with richer meanings are those that are connected to more properties or features. For instance, the pronoun HE provides little semantic information about the referent, because it is connected to very few features (e.g., being a man and being singular), whereas KING provides more information about the referent, because of its connection to other features that HE is not connected to.

Like other production theories (Levelt et al., 1999; Roelofs, 1992), I also assume that a lexical item is chosen via competition; a lexical item that receives a higher level of activation than alternatives gets selected (though, unlike Levelt et al., 1999, I assume that the activation of a lexical item is determined by the activation of a set of conceptual features, rather than an abstract concept). When speakers activate many different conceptual representations about the referent, words with many connections have a higher chance of receiving activation than those with very few

connections. This is because the activation of each conceptual representation or feature feeds into the activation of a lexical item, such that the more conceptual features a word is connected to, the more likely it receives a higher activation than words with fewer connections. However, when speakers activate very few conceptual features about the referent, words with fewer connections have an advantage over words with more connections. One possible reason for this is that the selection of a lexical item is also affected by how accessible the word is. One factor that affects a word's accessibility may be its frequency: The more frequent a word is, the more accessible it is. For instance, pronouns are more frequent than other noun phrases (Baayen, Piepenbrock, & Van Rijn, 1993), so they may be more accessible than other noun phrases. Therefore, when speakers activate very little conceptual information about the referent, pronouns are more likely to be selected, because they are more accessible than other noun phrases by virtue of their higher frequency. One obvious reason for why pronouns are more frequent compared to other noun phrases is that because of their conceptual emptiness, pronouns can refer to many different things, whereas other noun phrases with richer meanings are much more constrained in terms of what they could possibly refer to (e.g., *he* can refer to a king as well as a dog, but *man* can refer to a king, but not a dog). This might reflect a general principle that the more features a word is connected to, the more semantically constrained it is, and hence the less frequent it tends to occur compared to words with fewer features.

The accessibility of a lexical term may also be affected by recency: The more recently the word has been mentioned, the more accessible it is, which may in turn increase the chance of winning the competition. Indeed, research has found that after a shoe has been referred to by a subordinate term LOAFER, speakers are more likely

to repeat the subordinate term even when there is no other shoe present in the context (Brennan & Clark, 1996), presumably because the prior mention of the subordinate term overruled the frequency advantage of the basic-term. Recency may also explain why in my studies, participants normally produced either pronouns or repeated noun phrases; they hardly used other noun phrases than those used in the preceding sentence. This is presumably because when lexical items receive an equal amount of activation from the conceptual input, an item that is more accessible wins the competition against alternatives.

In sum, the choice of expression is determined by lexical competition, which is affected by the amount of conceptual features speakers access. When speakers activate many conceptual features about the referent, more explicit referring expressions, which are connected to more conceptual features, receive a higher activation than less explicit referring expressions. In contrast, when speakers activate few conceptual features about the referent, less explicit referring expressions have an advantage, because they are usually more frequent than more explicit referring expressions. As discussed earlier, how much conceptual information speakers activate depends upon how activated the referent's conceptual representation is in the speaker's discourse model when he or she has initiated message planning. As found in Chapters 4 and 6, when the context contains an entity that shares conceptual features with the referent, for instance, in terms of animacy (Chapter 6) and situational properties or affordances (Chapter 4), speakers experience interference, perhaps because the shared conceptual overlap between the referent and the competitor results in the activation of the competitor's representation. This reduces the referent's activation to the extent that speakers have to activate more conceptual features about the referent, which leads to a higher activation of more explicit

referring expressions. Perhaps such interference may also explain why the presence of an additional context in the visual context (Chapter 3) resulted in the production of more explicit referring expressions: When the visual context contains another human competitor, it interferes with the referent's conceptual access and requires additional conceptual activation compared to when there is no other competitor in the context.

However, such an activation-based processing model of referring expression is not entirely uncontroversial, especially from theoretical standpoints that regard the choice of expression as the product of speakers' monitoring of the needs of their addressee. As discussed elsewhere, I do not rule out that speakers *could* choose referring expressions based on their consideration for their addressee's comprehension. For instance, speakers avoid particular referring expressions if they know their addressee is less familiar with the expressions (or the objects they refer to) (Brennan & Clark, 1996; Horton & Gerring, 2002, 2005b; Issacs & Clark, 1987; Wilkes-Gibbs & Clark, 1992 amongst many). However, previous research has suggested that such adjustment occurs during later stages of production processes (Horton & Keysar, 1996) and does not take place when speakers are under cognitive pressure (Horton & Keysar, 1996), when speakers do not receive feedback from the addressee that suggests that audience design is necessary (Horton & Gerrig, 2002), or when the addressee's knowledge is not sufficiently salient to the speaker (Horton & Gerrig, 2005b). Indeed, speakers often fail to avoid ambiguous expressions if they have to rely upon their own comprehension system to detect ambiguity (Ferreira et al. 2005). Furthermore, as we have seen in Chapter 5 (Addressee's discourse model), the speaker's pronoun use is determined by the referent's accessibility to the speaker, but not to the addressee, suggesting that although speakers' audience design plays a

role under certain circumstances, depending on whether speakers realise that audience design is necessary, it does not appear to be an automatic processing component involved in the choice of referring expressions.

In conclusion, I have argued that the choice of referring expression is affected by the referent's level of activation in the speaker's preverbal message representation. When the referent is highly activated in the message, speakers need to encode less semantic information to increase its activation, whereas when the referent is less accessible, speakers need to encode more semantic representation to increase the referent's activation. That is, the explicitness of the referring expression depends upon how much conceptual information speakers encode to initiate linguistic encoding. This provides a way of accounting for the choice of referring expressions in the experiments that I conducted for this thesis. When visual context, animacy, and similarity-based interference make the referent less accessible, more semantic encoding is needed to initiate linguistic processes, resulting in more explicit referring expressions.

References

Aissen, J. (2003). Differential object marking: Iconicity vs. Economy. *Natural Language & Linguistic Theory, 21*(3), 435-483.

Allbritton, D. W., McKoon, G., & Ratcliff, R. (1996). Reliability of prosodic cues for resolving syntactic ambiguity. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22*(3), 714-735.

Almor, A. (1999). Noun-phrase anaphora and focus: The informational load hypothesis. *Psychological Review, 106*(4), 748-765.

Almor, A., Kempler, D., MacDonald, M. C., Andersen, E. S., & Tyler, L. K. (1999). Why do Alzheimer patients have difficulty with pronouns? Working memory, semantics, and reference in comprehension and production in Alzheimer's disease. *Brain and Language, 67*(3), 202-227.

Anderson, A., Garrod, S. C., & Sanford, A. J. (1983). The accessibility of pronominal antecedents as a function of episode shifts in narrative text. *Quarterly Journal of Experimental Psychology Section a-Human Experimental Psychology, 35*(AUG), 427-440.

Ariel, M. (1988). Referring and Accessibility. *Journal of Linguistics, 24*(1), 65-87.

Ariel, M. (1990). *Accessing noun-phrase antecedents*. London: Routledge.

Ariel, M. (2001). Accessibility theory: an overview. In J. S. T. Sanders, & W. Spooren (Ed.), *Text representation: Linguistic and psycholinguistic aspects* (pp. 29–87). Amsterdam/Philadelphia: John Benjamins.

Arnold, J. E. (2001). The effect of thematic roles on pronoun use and frequency of reference continuation. *Discourse Processes, 31*(2), 137-162.

Arnold, J. E. (2008). Reference production: Production-internal and addressee-oriented processes. *Language and Cognitive Processes, 23*(4), 495-527.

Arnold, J. E., & Griffin, Z. M. (2007). The effect of additional characters on choice of referring expression: Everyone counts. *Journal of Memory and Language, 56*(4), 521-536.

Arnold, J. E., Eisenband, J. G., Brown-Schmidt, S., & Trueswell, J. C. (2000). The rapid use of gender information: Evidence of the time course of pronoun resolution from eyetracking. *Cognition, 76*(1), B13-B26.

Arnold, J. E., Wasow, T., Asudeh, A., & Alrenga, P. (2004). Avoiding attachment ambiguities: The role of constituent ordering. *Journal of Memory and Language, 51*(1), 55-70.

Au, T. K. F. (1986). A verb is worth a thousand words: The causes and consequences of interpersonal events implicit in language. *Journal of Memory and Language, 25*(1), 104-122.

Baayen, R. H., Piepenbrock, R., & van Rijn, H. (1993). *The CELEX lexical database.* Philadelphia: Linguistic Data Consortium.

Baddeley, A. D. (1986). *Working memory.* Oxford: Clarendon Press.

Baddeley, A. D., & Hitch, G. (1974). Working memory. In G. H. Bower (Ed.), *The psychology of learning and motivation: Advances in research and theory* (Vol. 8, pp. 47-89). New York: Academic Press.

Bard, E. G., & Aylett, M. (2005). Referential form, duration, and modelling the listener in spoken dialogue. In J. Trueswell & M. Tanenhaus (Eds.), *Approaches to studying world-situated language use: Bridging the language-as-product and language-as-action traditions* (pp. 173-191). Cambridge: MIT Press.

Barr, D. J. (2008). Pragmatic expectations and linguistic evidence: Listeners anticipate but do not integrate common ground. *Cognition, 109*(1), 18-40.

Beun, R. J., & Cremers, A. H. M. (1998). Object reference in a shared domain of conversation. *Pragmatics & Cognition, 6*(1-2), 121-152.

Bock, J. K. (1982). Toward a cognitive psychology of syntax: Information-processing contributions to sentence formulation. *Psychological Review, 89*(1), 1-47.

Bock, J. K., & Irwin, D. E. (1980). Syntactic effects of information availability in sentence production. *Journal of Verbal Learning and Verbal Behavior, 19*(4), 467-484.

Bock, J. K., & Levelt, W. J. M. (1994). Language production: Grammatical encoding. In M. A. Gernsbacher (Ed.), *Handbook of psycholinguistics* (pp. 945–984). San Diego, CA: Academic.

Bock, J. K., & Warren, R. K. (1985). Conceptual accessibility and syntactic structure in sentence formulation. *Cognition, 21*(1), 47-67.

Bock, J. K., Irwin, D. E., Davidson, D. J., & Levelt, W. J. M. (2003). Minding the clock. *Journal of Memory and Language, 48*(4), 653-685.

Bock, J. K., Loebell, H., & Morey, R. (1992). From conceptual roles to structural relations: Bridging the syntactic cleft. *Psychological Review, 99*(1), 150-171.

Branigan, H. P., Pickering, M. J., & Tanaka, M. (2008). Contributions of animacy to grammatical function assignment and word order during production. *Lingua, 118*(2), 172-189.

Brennan, S. E. (1995). Centering attention in discourse. *Language and Cognitive Processes, 10*(2), 137-167.

Brennan, S. E., & Clark, H. H. (1996). Conceptual pacts and lexical choice in conversation. *Journal of Experimental Psychology: Learning, Memory and Cognition, 22*(6), 1482-1493.

Brennan, S. E., Friedman, M. W., & Pollard, C. J. (1987). A centering approach to pronouns. In *Proceedings of the 25th annual meeting of the association for computational linguistics* (pp. 155-162). Cambridge, MA: Association for Computational Linguistics.

Broadbent, D. E. (1958). *Perception and communication*. London: Pergamon Press.

Brown, P. M., & Dell, G. S. (1987). Adapting production to comprehension: The explicit mention of instruments. *Cognitive Psychology, 19*, 441-472.

Brown, R., & Fish, D. (1983). The psychological causality implicit in language. *Cognition, 14*(3), 237-273.

Brown-Schmidt, S., & Konopka, A. E. (2008). Little houses and casas pequenas: Message formulation and syntactic form in unscripted speech with speakers of English and Spanish. *Cognition, 109*(2), 274-280.

Brown-Schmidt, S., & Tanenhaus, M. K. (2006). Watching the eyes when talking about size: An investigation of message formulation and utterance planning. *Journal of Memory and Language, 54*(4), 592-609.

Caramazza, A. (1997). How many levels of processing are there in lexical access? *Cognitive Neuropsychology, 14*(1), 177-208.

Caramazza, A., Grober, E., Garvey, C., & Yates, J. (1977). Comprehension of anaphoric pronouns. *Journal of Verbal Learning and Verbal Behavior, 16*(5), 601-109.

Carroll, J. M. (1980). Naming and Describing in Social Communication. *Language and Speech, 23*(4), 309-322.

Chafe, W. L. (1974). Language and Consciousness. *Language, 50*(1), 111-133.

Chafe, W. L. (1976). Givenness, contrastiveness, definiteness, subjects, topics, and points of view. In C. N. Li (Ed.), *Subject and topic*. New York: Academic.

Chafe, W. L. (1994). *Discourse, consciousness, and time*. Chicago: Chicago University Press.

Chambers, C. G., & Smyth, R. H. (1998). Structural parallelism and discourse coherence: A test of centering theory. *Journal of Memory and Language, 39*(4), 593-608.

Chambers, C. G., Tanenhaus, M. K., Eberhard, K. M., Filip, H., & Carlson, G. N. (2002). Circumscribing referential domains during real-time language comprehension. *Journal of Memory and Language, 47*(1), 30-49.

Chambers, C. G., Tanenhaus, M. K., & Magnuson, J. S. (2004). Actions and affordances in syntactic ambiguity resolution. *Journal of Experimental Psychology: Learning Memory and Cognition, 30*(3), 687-696.

Clancy, P. M. (1980). Referential choice in English and Japanese narrative discourse. In W. Chafe (Ed.), *The pear stories: Cognitive, cultural, and linguistic aspects of narrative production* (Vol. 3, pp. 127-201). Norwood, NJ: Ablex.

Clark, H. H. (1996). *Using language*. Cambridge: CUP.

Clark, H. H., & Begun, J. S. (1971). Semantics of sentence subjects. *Language and Speech, 14*(1), 34-46.

Clark, H. H., & Carlson, T. B. (1982). Context for comprehension. In J. Long & A. Baddeley (Eds.), *Attention and performance* (pp. 1-37). New York: Academic Press.

Clark, H. H., & Marshall, C. R. (1981). Definite reference and mutual knowledge. In A. K. Joshi, B. Webber & I. Sag (Eds.), *Elements of discourse understanding* (pp. 10-63). Cambridge: Cambridge University Press.

Clark, H. H., & Murphy, G. L. (1982). Audience design in meaning and reference. In J. F. L. Ny & W. Kintsch (Eds.), *Language and comprehension* (pp. 287-299). Amsterdam: North Holland.

Clark, H. H., & Schaefer, E. F. (1987). Concealing One's Meaning from Overhearers. *Journal of Memory and Language, 26*(2), 209-225.

Clark, H. H., & Schaefer, E. F. (1989). Contributing to Discourse. *Cognitive Science, 13*(2), 259-294.

Clark, H. H., & Wilkes-Gibbs, D. (1986). Referring as a collaborative process. *Cognition, 22*(1), 1-39.

Comrie, B., 1989. *Language universals and linguistic typology*. Chicago: University of Chicago Press.

Cooper, R. M. (1974). Control of eye fixation by meaning of spoken language: New methodology for real-time investigation of speech perception, memory, and language processing. *Cognitive Psychology, 6*(1), 84-107.

Crawley, R. A., & Stevenson, R. J. (1990). Reference in Single Sentences and in Texts. *Journal of Psycholinguistic Research, 19*(3), 191-210.

Crinean, M., & Garnham, A. (2006). Implicit causality, implicit consequentiality and semantic roles. *Language and Cognitive Processes, 21*(5), 636-648.

Dahl, Ö., & Fraurud, K. (1996). Animacy in grammar and discourse. In J. K. G. T. Fretheim (Ed.), *Reference and referent accessibility* (pp. 47-64). Amsterdam: John Benjamins.

Davidson, D. (1971). Agency. In R. B. R. Binkley, & A. Marras (Ed.), *Agent, action, and reason* (pp.43-61). Toronto: University of Toronto Press.

Dell, G. S., & Brown, P. M. (1991). Mechanisms for listener-adaptation in language production: limiting the role of the "model of the listener". In D. Napoli & J. Kegl (Eds.), *Bridges between psychology and linguistics (*pp. 105–129). New York: Academic Press.

Dell, G. S., & O'Seaghdha, P. G. (1992). Stages of lexical access in language production. *Cognition, 42*(1-3), 287-314.

Dell, G. S., Schwartz, M. F., Martin, N., Saffran, E. M., & Gagnon, D. A. (1997). Lexical access in aphasic and nonaphasic speakers. *Psychological Review, 104*(4), 801-838.

Ehrlich, S. (1990). *Point of view: A linguistic analysis of literary style*. London: Routledge.

Ellis, R., Tucker, M., Symes, E., & Vainio, L. (2007). Does selecting one visual object from several require inhibition of the actions associated with nonselected objects? *Journal of Experimental Psychology: Human Perception and Performance, 33*(3), 670-691.

Eriksen, B. A., & Eriksen, C. W. (1974). Effects of noise letters upon identification of a target letter in a nonsearch task. *Perception & Psychophysics, 16*(1), 143-149.

Ferreira, F. (1994). Choice of passive voice is affected by verb type and animacy. *Journal of Memory and Language, 33*(6), 715-736.

Ferreira, V. S., & Dell, G. S. (2000). Effect of ambiguity and lexical availability on syntactic and lexical production. *Cognitive Psychology, 40*(4), 296-340.

Ferreira, V. S., & Yoshita, H. (2003). Given-new ordering effects on the production of scrambled sentences in Japanese. *Journal of Psycholinguistic Research, 32*(6), 669-692.

Ferreira, V. S., Slevc, L. R., & Rogers, E. S. (2005). How do speakers avoid ambiguous linguistic expressions? *Cognition, 96*(3), 263-284.

Fletcher, C. R. (1984). Markedness and topic continuity in discourse processing. *Journal of Verbal Learning and Verbal Behavior, 23*(4), 487-493.

Foley, W. A., & Van Valin, R.D. (1985). Information packaging in the clause. In T. Shopen (Ed.), *Language typology and syntactic description* (Vol. 1, pp. 282-364). Cambridge: Cambridge University Press.

Foraker, S., & McElree, B. (2007). The role of prominence in pronoun resolution: Active versus passive representations. *Journal of Memory and Language, 56*(3), 357-383.

Forster, K. I., & Forster, J. C. (2003). Dmdx: A windows display program with millisecond accuracy. *Behavior Research Methods Instruments & Computers, 35*(1), 116-124.

Fowler, R. (1977). *Linguistics and the novel*. London: Routledge.

Fukumura, K., & Van Gompel, R. P. G. (in press). The effect of animacy on the choice of referring expression. *Language and Cognitive Processes.*

Fukumura, K., & Van Gompel, R. P. G. (2010). Choosing anaphoric expressions: Do people take into account likelihood of reference? *Journal of Memory and Language, 62*(1), 52-66.

Fukumura, K., Van Gompel, R.P.G., Pickering, M.J. (2010). The use of visual context during the production of referring expressions. *Quarterly Journal of Experimental Psychology*, First published on: 01 February 2010 (iFirst)

Fussell, S. R., & Krauss, R. M. (1992). Coordination of knowledge in communication: effects of speakers assumptions about what others know. *Journal of Personality and Social Psychology, 62*(3), 378-391.

García, E. C. (1996). What "reflexivity" is really like. *Linguistics, 34*(1), 1-51.

Garrod, S., & Anderson, A. (1987). Saying what you mean in dialog: a study in conceptual and semantic coordination. *Cognition, 27*(2), 181-218.

Garrod, S., & Sanford, A. (1977). Interpreting anaphoric relations: The integration of semantic information while reading. *Journal of Verbal Learning and Verbal Behavior*, *16*(1), 77-90.

Garvey, C., & Caramazza, A. (1974). Implicit causality in verbs. *Linguistic Inquiry, 5*(3), 459-464.

Garvey, C., Caramazza, A., & Yates, J. (1975). Factors influencing assignment of pronoun antecedents. *Cognition, 3*(3), 227-243.

Gernsbacher, M. A., & Hargreaves, D. J. (1988). Accessing sentence participants: the advantage of first mention. *Journal of Memory and Language, 27*(6), 699-717.

Gernsbacher, M. A., Hargreaves, D. J., & Beeman, M. (1989). Building and accessing clausal representations: The advantage of first mention versus the advantage of clause recency. *Journal of Memory and Language, 28*(6), 735-755.

Gerrig, R. J. (1986). Process models and pragmatics. In N. E. Sharkey (Ed.), *Advances in cognitive science* (pp. 23-42). Chichester, England: Ellis Horwood.

Givón, T. (1983a). Topic continuity in discourse: An introduction. In T. Givón (Ed.), *Topic continuity in discourse: A quantitative cross-language study* (pp. 1-41). Amsterdam: John Benjamins.

Givón, T. (1983b). Topic continuity in spoken English. In T. Givón (Ed.), *Topic continuity in discourse: A quantitative cross-language study* (pp. 347-363). Amsterdam: John Benjamins.

Givón, T. (1988). The pragmatics of word order: Predictability, importance and attention. In M. Hammond, E. A. Moravcsik & J. R. Wirth (Eds.), *Studies in syntactic typology* (Vol. 17, pp. 243-284). Amsterdam: John Benjamins.

Givón, T. (1989). *Mind, Code, and Context: Essays in Pragmatics*. Hillsdale, N.J.: L. Erlbaum Associates.

Givón, T. (1992). The grammar of referential coherence as mental processing instructions. *Linguistics, 30*(1), 5-55.

Gleitman, L. R., January, D., Nappa, R., & Trueswell, J. C. (2007). On the give and take between event apprehension and utterance formulation. *Journal of Memory and Language, 57*(4), 544-569.

Gordon, P. C., & Chan, D. (1995). Pronouns, passives, and discourse coherence. *Journal of Memory and Language, 34*(2), 216-231.

Gordon, P. C., & Hendrick, R. (1998). The representation and processing of coreference in discourse. *Cognitive Science, 22*(4), 389-424.

Gordon, P. C., Grosz, B. J., & Gilliom, L. A. (1993). Pronouns, names, and the centering of attention in discourse. *Cognitive Science, 17*(3), 311-347.

Grice, H. P. (1975). Logic and conversation. In P. Cole & J. Morgan (Eds.), *Syntax and Semantics Vol. III: Speech acts* (pp. 41-58). New York: Academic Press.

Griffin, Z. M., & Bock, J. K. (2000). What the eyes say about speaking. *Psychological Science, 11*(4), 274-279.

Grober, E., Beardsley, W. & Caramazza, A. (1978). Parallel function strategy in pronoun assignment. *Cognition, 6*(2), 117-133.

Grosz, B. J., Joshi, A. K., & Weinstein, S. (1995). Centering: a framework for modelling the local coherence of discourse. *Computational Linguistics, 21*(2), 203-225.

Gundel, J. K., Hedberg, N., & Zacharski, R. (1993). Cognitive status and the form of anaphoric expressions in discourse. *Language, 69*(2), 274-307.

Gundel, J., Hedberg, N., & Zacharski, R. (2005). Pronouns without NP antecedents: How do we know when a pronoun is referential? In A. Branco**,** T. McEnery, & R. Mitkov (Eds.), *Anaphora processing: linguistic, cognitive and computational modelling* (pp. 351-364). Amsterdam: John Benjamins.

Hanna, J. E., Tanenhaus, M. K., & Trueswell, J. C. (2003). The effects of common ground and perspective on domains of referential interpretation. *Journal of Memory and Language*, *49*(1), 43-61.

Haywood, S. L., Pickering, M. J., & Branigan, H. P. (2005). Do speakers avoid ambiguities during dialogue? *Psychological Science, 16*(5), 362-366.

Heller, D., Grodner, D., & Tanenhaus, M. K. (2008). The role of perspective in identifying domains of reference. *Cognition, 108*(3), 831-836.

Hinds, J. (1983). Topic continuity in Japanese. In T. Givón (Ed.), *Topic continuity in discourse: A quantitative cross-language study* (pp. 1-41). Amsterdam: John Benjamins.

Horton, W. S., & Gerrig, R. J. (2002). Speakers' experiences and audience design: knowing when and knowing how to adjust utterances to addressees. *Journal of Memory and Language, 47*(4), 589-606.

Horton, W. S., & Gerrig, R. J. (2005a). Conversational common ground and memory processes in language production. *Discourse Processes, 40*(1), 1-35.

Horton, W. S., & Gerrig, R. J. (2005b). The impact of memory demands on audience design during language production. *Cognition, 96*(2), 127-142.

Horton, W. S., & Keysar, B. (1996). When do speakers take into account common ground? *Cognition, 59*(1), 91-117.

Isaacs, E. A., & Clark, H. H. (1987). References in conversation between experts and novices. *Journal of Experimental Psychology: General, 116*(1), 26-37.

Itagaki, N., & Prideaux, G. D. (1985). Nominal properties as determinants of subject selection. *Lingua, 66*(2-3), 135-149.

Jaeger, T. F. (2008). Categorical data analysis: Away from ANOVAs (transformation or not) and towards logit mixed models. *Journal of Memory and Language, 59*(4), 434-446.

Johnson-Laird, P. N. (1983). *Mental models: Towards a cognitive science of language, inference, and consciousness*. Cambridge: Cambridge University Press.

Joshi, A., & Weinstcin, S. (1981). Control of inference: Role of some aspects of discoursestructured centering. In *Proceedings of the 7th international joint conference on artificial intelligence* (pp. 385-387). San Francisco: Morgan Kaufmann Publishers

Just, M. A., & Carpenter, P. A. (1992). A capacity theory of comprehension: Individual differences in working memory. *Psychological Review, 99*(1), 122-149.

Kahneman, D. (1973). *Attention and effort*. Englewood Cliffs, NJ: Prentice-Hall.

Kehler, A., Kertz, L., Rohde, H., & Elman, J. L. (2008). Coherence and Coreference Revisited. *Journal of Semantics, 25*(1), 1-44.

Keysar, B., Barr, D. J., Balin, J. A., & Brauner, J. S. (2000). Taking perspective in conversation: The role of mutual knowledge in comprehension. *Psychological Science, 11*(1), 32-38.

Keysar, B., Barr, D. J., Balin, J. A., & Paek, T. S. (1998). Definite reference and mutual knowledge: Process models of common ground in comprehension. *Journal of Memory and Language, 39*(1), 1-20.

Keysar, B., Lin, S., & Barr, D. J. (2003). Limits on theory of mind use in adults. *Cognition*, *89*(1), 25–41.

Kintsch, W., & Van Dijk, T. A. (1978). Toward a model of text comprehension and production. *Psychological Review, 85*(5), 363-394.

Koornneef, A. W., & Van Berkum, J. J. A. (2006). On the use of verb-based implicit causality in sentence comprehension: Evidence from self-paced reading and eye tracking. *Journal of Memory and Language, 54*(4), 445-465.

Kraljic, T., & Brennan, S. E. (2005). Prosodic disambiguation of syntactic structure: For the speaker or for the addressee? *Cognitive Psychology, 50*(2), 194-231.

Krauss, R. M., & Weinheimer, S. (1964). Changes in reference phrases as a function of frequency of usage in social interaction: A preliminary study. *Psychonomic Science*, *1*, 113-114.

Krauss, R. M., & Weinheimer, S. (1966). Concurrent feedback confirmation and encoding of referents in verbal communication. *Journal of Personality and Social Psychology, 4*(3), 343-346.

Krauss, R. M., Garlock, C. M., Bricker, P. D., & McMahon, L. E. (1977). Role of audible and visible back-channel responses in interpersonal communication. *Journal of Personality and Social Psychology, 35*(7), 523-529.

Kuno, S. (1972). Functional sentence perspective: A case study from Japanese and English. *Linguistic Inquiry, 3*(3), 269-320.

Kuno, S., & Kaburaki, E. (1977). Empathy and syntax. *Linguistic Inquiry, 8*(4), 627-672.

Langacker, R. W. (1991). *Foundations of cognitive grammar: Descriptive application* (Vol. 2). Stanford: Stanford University Press.

Levelt, W. J. M. (1989). *Speaking: From intention to articulation*. Cambridge, CA: MIT Press.

Levelt, W. J. M. (1999). Models of word production. *Trends in Cognitive Sciences, 3*(6), 223-232.

Levelt, W. J. M. (2001). Spoken word production: A theory of lexical access. *Proceedings of the national academy of sciences of the United States of America, 98*(23), 13464-13471.

Levelt, W. J. M., Roelofs, A., & Meyer, A. S. (1999). A theory of lexical access in speech production. *Behavioral and Brain Sciences, 22*(1), 1-38.

Lewis, D. K. (1969). *Convention: A Philosophical Study*. Cambridge, MA: Harvard University Press.

Lockridge, C. B., & Brennan, S. E. (2002). Addressees' needs influence speakers' early syntactic choices. *Psychonomic Bulletin & Review, 9*(3), 550-557.

Long, D. L., & De Ley, L. (2000). Implicit causality and discourse focus: The interaction of text and reader characteristics in pronoun resolution. *Journal of Memory and Language, 42*(4), 545-570.

Marslen Wilson, W. D., Levy, E., & Tyler, L. K. (1982). Producing interpretable discourse: The establishment and maintenance of reference. In R. J. Jarvella & W. Klein (Eds.), *Speech, place, and action* (pp. 339-379). Chichester: John Wiley & Sons.

Matthews, D., Lieven, E., Theakston, A., & Tomasello, M. (2006). The effect of perceptual availability and prior discourse on young children's use of referring expressions. *Applied Psycholinguistics, 27*(03), 403-422.

McDonald, J. L., Bock, K., & Kelly, M. H. (1993). Word and world order: Semantic, phonological, and metrical determinants of serial position. *Cognitive Psychology, 25*(2), 188-230.

McElree, B. (1996). Accessing short-term memory with semantic and phonological information: A time-course analysis. *Memory & Cognition*, *24*(2), 173–187.

McElree, B. (1998). Attended and non-attended states in working memory: Accessing categorized structures. *Journal of Memory and Language, 38*(2), 225-252.

McElree, B., & Dosher, B. A. (1989). Serial position and set size in short-term memory: The time course of recognition. *Journal of Experimental Psychology: General, 118*(4), 346-373.

McElree, B., & Dosher, B. A. (1993). Serial retrieval processes in the recovery of order information. *Journal of Experimental Psychology: General, 122*(3), 291-315.

McKoon, G., Greene, S. B., & Ratcliff, R. (1993). Discourse models, pronoun resolution, and the implicit causality of verbs. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19*(5), 1040-1052.

Nadig, A. S., & Sedivy, J. C. (2002). Evidence of perspective-taking constraints in children's on-line reference resolution. *Psychological Science, 13*(4), 329-336.

O'Brien, E. J., & Albrecht, J. E. (1991). The role of context in accessing antecedents in text. *Journal of Experimental Psychology: Learning Memory and Cognition, 17*(1), 94-102.

Olson, D. R. (1970). Language and thought - aspects of a cognitive theory of semantics. *Psychological Review, 77*(4), 257-273.

Osgood, C. E. (1971). Where do sentences come from? In D. D. Steinberg & L. A. Jakobovits (Eds.), *Semantics: An interdisciplinary reader in philosophy, linguistics and psychology* (pp. 497–529). London: Cambridge University Press.

Pearson, J., Stevenson, R., & Poesio, M. (2001). The effects of animacy, thematic role, and surface position on the focusing of entities in discourse. In M. Poesio (Ed.), *Proceedings of the first workshop on cognitively plausible models of semantic processing*. University of Edinburgh.

Pickering, M. J., & Garrod, S. (2004). Toward a mechanistic psychology of dialogue. *Behavioral and Brain Sciences, 27*(2), 169-226.

Pollatsek, A., & Well, A. D. (1995). On the use of counterbalanced designs in cognitive research - a suggestion for a better and more powerful analysis. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21*(3), 785-794.

Prat-Sala, M., & Branigan, H. P. (2000). Discourse constraints on syntactic processing in language production: A cross-linguistic study in English and Spanish. *Journal of Memory and Language, 42*(2), 168-182.

Prince, E. F. (1981). Toward a taxonomy of given-new information. In P. Cole (Ed.), *Radical Pragmatics* (pp. 223-255). New York: Academic Press.

Prince, E. F. (1985). Fancy Syntax and Shared Knowledge. *Journal of Pragmatics, 9*(1), 65-81.

Purkiss, E. *The effect of foregrounding on pronominal reference.* Unpublished undergraduate thesis, University of Glasgow (Cited in A. J. Sanford & S.C. Garrod, 1981).

Reinhart, T. (1982). *Pragmatics and linguistics: An analysis of sentence topics*. Bloomington, IN: Indiana University.

Roelofs, A. (1992). A spreading-activation theory of lemma retrieval in speaking. *Cognition, 42*(1-3), 107-142.

Rosch, E., Mervis, C. B., Gray, W. D., Johnson, D. M., & Boyesbraem, P. (1976). Basic objects in natural categories. *Cognitive Psychology, 8*(3), 382-439.

Rosenbach, A. (2002). *Genitive variation in English. Conceptual factors in synchronic and diachronic studies*. Berlin: Mouton de Gruyter.

Rossnagel, C. (2000). Cognitive load and perspective-taking: Applying the automatic-controlled distinction to verbal communication. *European Journal of Social Psychology, 30*(3), 429-445.

Sanford, A., & Garrod, S. (1981). *Understanding written language: explorations in comprehension beyond the sentence*. Chichester: J. Wiley & Sons.

Schafer, A. J., Speer, S. R., Warren, P., & White, S. D. (2000). Intonational disambiguation in sentence production and comprehension. *Journal of Psycholinguistic Research, 29*(2), 169-182.

Schelling, T. C. (1960). *The strategy of conflict*. Cambridge, Mass.: Harvard University Press.

Schiffer, S. (1972). *Meaning*. Oxford: Oxford University Press.

Schneider, W., & Detweiler, M. (1988). The role of practice in dual-task performance: Toward workload modeling in a connectionist control architecture. *Human Factors, 30*(5), 539-566.

Schober, M. F., & Clark, H. H. (1989). Understanding by addressees and overhearers. *Cognitive Psychology, 21*(2), 211-232.

Sedivy, J. C. (2003). Pragmatic versus form-based accounts of referential contrast: Evidence for effects of informativity expectations. *Journal of Psycholinguistic Research, 32*(1), 3-23.

Shallice, T., & Vallar, G. (1990). The impairment of auditory-verbal short-term storage. In G. Vallar & T. Shallice (Eds.), *Neuropsychological impairments of short-term memory* (pp. 11-53). New York: Cambridge University Press.

Sheldon, A. (1974). The role of parallel function in the acquisition of relative clauses in English. *Journal of Verbal Learning and Verbal Behavior, 13*(3), 272-281.

Silverstein, M. (1976). Hierarchy of features an ergativity. In R. M. W. Dixon (Ed.), *Grammatical categories in Australian languages* (pp. 112-171). Canberra, NJ: Humanities Press.

Smyth, R. (1994). Grammatical determinants of ambiguous pronoun resolution. *Journal of Psycholinguistic Research, 23*(2), 197-229.

Snedeker, J., & Trueswell, J. (2003). Using prosody to avoid ambiguity: Effects of speaker awareness and referential context. *Journal of Memory and Language, 48*(1), 103-130.

Stevenson, R. J. (2002). The Role of Salience in the Production of Referring Expressions: A psycholinguistic perspective. In K. v. Deemter & R. Kibble (Eds.), *Information sharing: Reference and presupposition in language Generation and Interpretation* (pp. 167-192). Stanford: CSLI Publications.

Stevenson, R. J., Crawley, R. A., & Kleinman, D. (1994). Thematic roles, focus and the representation of events. *Language and Cognitive Processes, 9*(4), 519-548.

Stevenson, R. J., Knott, A., Oberlander, J., & McDonald, S. (2000). Interpreting pronouns and connectives: Interactions among focusing, thematic roles and coherence relations. *Language and Cognitive Processes, 15*(3), 225-262.

Stevenson, R. J., Nelson, A. W. R., & Stenning, K. (1995). The role of parallelism in strategics of pronoun comprehension. *Language and Speech, 38*, 393-418.

Stroop, J. R. (1935). Studies of interference in serial verbal reaction. *Journal of Experimental Psychology, 18*, 643-662.

Tanenhaus, M. K., Spivey Knowlton, M. J., Eberhard, K. M., & Sedivy, J. C. (1995). Integration of visual and linguistic information in spoken language comprehension. *Science, 268*(5217), 1632-1634.

Tanenhaus, M. K., Spivey-Knowlton, M. J., & Hanna, J. E. (2000). Modelling thematic and discourse context effects on ambiguity resolution within a multiple constraints framework: Implications for the architecture of the language processing system. In M. W. Crocker, M. Pickering, & C. Clifton, Jr. (Eds.), *Architectures and mechanisms for language processing* (pp. 90–118). Cambridge: Cambridge University

Van Berkum, J. J. A., Koornneef, A. W., Otten, M., & Neuwland, M. S. (2007). Establishing reference in language comprehension: An electrophysiological perspective. *Brain Research, 1146*, 158-171.

Van Gompel, R. P. G., Liversedge, S. P., & Pearson, J. (2004). Antecedent typicality effects in the processing of noun phrase anaphors. In M. Carreiras & C. E. Clifton (Eds.), *The on-line study of sentence comprehension: Eyetracking, ERP and beyond* (pp. 119 - 138): Psychology Press.

Van Nice, K. Y., & Dietrich, R. (2003). Task sensitivity of animacy effects: Evidence from German picture descriptions. *Linguistics, 41*(5), 825-849.

Vonk, W. (1985). On the purpose of reading and the immediacy of processing pronouns. In R. Groner, G. W. McConkie, & C. Menz (Eds.), *Eye movements and human information processing* (pp. 207-215). Amsterdam: Elsevier.

Vonk, W., Hustinx, L., & Simons, W. H. G. (1992). The use of referential expressions in structuring discourse. *Language and Cognitive Processes, 7*(3-4), 301-333.

Walker, M. A., Joshi, A. K., & Prince, E. F. (Eds.). (1998). *Centering theory in discourse*. Oxford: Clarendon Press.

Wardlow Lane, L. W., & Ferreira, V. S. (2008). Speaker-external versus speaker-internal forces on utterance form: Do cognitive demands override threats to referential success? *Journal of Experimental Psychology: Learning Memory and Cognition, 34*(6), 1466-1481.

Wardlow Lane, L. W., Groisman, M., & Ferreira, V. S. (2006). Don't talk about pink elephants! *Psychological Science, 17*(4), 273-277.

Wickelgren, W. A., Corbett, A. T., & Dosher, B. A. (1980). Priming and retrieval from short-term-memory: a speed accuracy trade-off analysis. *Journal of Verbal Learning and Verbal Behavior, 19*(4), 387-404.

Wilkes-Gibbs, D., & Clark, H. H. (1992). Coordinating beliefs in conversation. *Journal of Memory and Language, 31*(2), 183–194.

Winer, B. (1971). *Statistical principles in experimental design*. New York: McGraw-Hill Book Co.

Wu, S. L., & Keysar, B. (2007). The effect of information overlap on communication effectiveness. *Cognitive Science, 31*(1), 169-181.

Yamamoto, M. (1999). *Animacy and reference: A cognitive approach to corpus linguistics*. Amsterdam: John Benjamins Publishing.

Appendices

Appendix 1: Experimental materials (Ch 3. Visual Salience)

Context sentences and events depicted in the target pictures (in capitals). In Experiment 1, inclusion of the phrase in parentheses created the competitor-mentioned condition and omission of this phrase created the competitor-not-mentioned condition. In Experiment 2, the gender of the competitor was manipulated, with the same-gender condition before the slash and the different-gender condition after the slash.

Experiment 1

The cowboy's gun had been used (by an Indian). COWBOY PICKING UP GUN.

The mermaid's shell had been found (by a woman). MERMAID PUTTING SHELL ONTO HER CROWN.

The boy's canoe had been transported (by a pirate). BOY SITTING DOWN IN CANOE.

The king's sink had been repaired (by a plumber). KING TURNING ON TAP.

The stewardess's slippers had been washed (by a princess). STEWARDESS PUTTING ON SLIPPERS.

The gardener's car had been moved (by a policeman). GARDENER GETTING INTO CAR.

The witch's treasure chest had been opened (by a queen). WITCH CLOSING LID.

The admiral's map had been returned (by a firefighter). ADMIRAL LOOKING AT MAP.

The sheriff's chair had been assembled (by a gladiator). SHERIFF FALLING OFF CHAIR.

The princess's plants had been watered (by a nun). PRINCESS TAKING PLANTS OUT OF POT.

The footballer's ball had been found (by a cowboy). FOOTBALLER KICKING BALL.

The woman's sofa had been vacuumed (by a girl). WOMAN SITTING DOWN ON SOFA.

The pirate's carpet had been cleaned (by a prince). PIRATE LYING DOWN ON CARPET.

The lady's roses had been pruned (by a stewardess). LADY TOUCHING ROSES.

The Indian's binoculars had been discovered (by a gardener). INDIAN LOOKING THROUGH BINOCULARS.

The nanny's camera had been damaged (by a mermaid). NANNY PUTTING CAMERA OVER HER SHOULDER.

The firefighter's megaphone had been donated (by a king). FIREFIGHTER PICKING UP MEGAPHONE.

The gladiator's helmet had been repainted (by a boy). GLADIATOR PUTTING ON HELMET.

The girl's wheelchair had been donated (by a witch). GIRL SITTING DOWN IN WHEELCHAIR.

The plumber's tea had been served (by an admiral). PLUMBER PICKING UP CUP.

The nun's diary had been published (by a lady). NUN TAKING DIARY AWAY.

The policeman's balloon had been found (by a footballer). POLICEMAN PICKING UP BALLOON.

The queen's candle had been dusted (by a nanny). QUEEN TAKING CANDLE AWAY.

The prince's fountain had been repaired (by a sheriff). PRINCE STANDING ON FOUNTAIN.

Experiment 2

The Indian's gun had been given by an admiral/countess. INDIAN PICKING UP GUN.

The queen's candle had been lit by a nanny/cowboy. QUEEN TAKING CANDLE AWAY.

The king's sink had been repaired by a gentleman/lady. KING TURNING ON TAP.

The woman's slippers had been washed by a princess/prince. WOMAN PUTTING ON SLIPPERS.

The boy's canoe had been transported by a wizard/witch. BOY SITTING DOWN IN CANOE.

The gardener's car had been moved by a policeman/policewoman. GARDENER GETTING INTO CAR.

The admiral's map had been returned by a groom/bride. ADMIRAL LOOKING AT MAP.

The countess's roses had been pruned by a stewardess/pilot. COUNTESS TOUCHING ROSES.

The witch's treasure chest had been opened by a queen/king. WITCH CLOSING LID.

The sheriff's chair had been assembled by a pirate/mermaid. SHERIFF STANDING UP FROM CHAIR.

The footballer's ball had been found by a priest/nun. FOOTBALLER KICKING BALL.

The woman's sofa had been vacuumed by a girl/boy. WOMAN SITTING DOWN ON SOFA.

The pirate's carpet had been cleaned by a prince. PIRATE LYING DOWN ON CARPET.

The Indian's binoculars had been discovered by a pilot/stewardess. INDIAN LOOKING THROUGH BINOCULARS.

The nanny's camera had been damaged by a pirate/mermaid. NANNY PUTTING CAMERA OVER HER SHOULDER.

The firefighter's megaphone had been donated by a king/queen. FIREFIGHTER PICKING UP MEGAPHONE.

The gladiator's helmet had been repainted by a boy/girl. GLADIATOR PUTTING ON HELMET.

The princess's plants had been watered by a nun/priest. PRINCESS TAKING PLANTS OUT OF POT.

The plumber's tea had been served by a groom/bride. PLUMBER PICKING UP CUP.

The gladiator's sword had been found by a policeman/policewoman. GLADIATOR PICKING UP SWORD.

The mermaid’s shell had been found by a lady/gentleman. MERMAID PUTTING SHELL ONTO HER CROWN.

The prince's fountain had been repaired by a cowboy/nanny. PRINCE STANDING ONTO FOUNTAIN.

The girl's wheelchair had been donated by a witch/wizard. GIRL SITTING DOWN ON WHEELCHAIR.

The nun's diary had been published by a countess/admiral. NUN TAKING DIARY AWAY.

Appendix 2: Arcsine transformation formulas used in the analyses

Because proportions have a binomial distribution, the following transformations were applied (Winer, 1970), where X is a proportion.

$$X' = 2 \arcsin \sqrt{X}$$

If the proportion was 0 or 1, the following transformation was applied (n = the number of observations on which X is based).

$$X' = 2 \arcsin \sqrt{X \pm [1/2n]}$$

Appendix 3: Results from logit mixed-effects modelling (Ch 3. Visual salience)

	Estimate	SE of estimate	*z*	*p*
Experiment 1				
mention	-0.993	0.131	-7.564	<.001
presence	-1.347	0.138	-9.751	<.001
mention*presence	-0.249	0.127	-1.964	.050
presence effect for mentioned condition	-3.200	0.392	-8.158	<.001
presence effect for not-mentioned condition	-2.204	0.357	-6.173	<.001
Experiment 2				
ambiguity	0.802	0.141	5.689	<.001
presence	-1.443	0.151	-9.547	<.001
ambiguity*presence	0.413	0.139	2.973	.003
presence effect for ambiguous condition	-3.715	0.4656	-7.979	<.001
presence effect for unambiguous condition	-2.066	0.3468	-5.959	<.001

Appendix 4: Experimental materials (Ch 4. Affordances)

Context sentences and events depicted in the target pictures (in capitals). In Experiment 1, the gender of a second-mentioned character in the propositional with-phrase was manipulated, with the same-gender condition before the slash and the different-gender condition after the slash. In the same situation condition, the referent and the competitor each had the object in bold, whereas in the different situation condition, only the referent had the object in bold. In Experiment 2, the type of action was manipulated, with the related action condition before the slash and the unrelated action condition after the slash.

Experiment 1

The witch visited the garden with the girl/boy. WITCH DROPPING **ICE CREAM**.

The Indian went to the forest with the admiral/countess. INDIAN SHOOTING WITH **GUN**.

The countess came out of the house with the priest/nun. COUNTESS LOWERING **PARASOL**.

The king visited the castle with the stewardess/pilot. KING GETTING OFF **HORSE**.

The captain was invited to the palace with the policeman/policewoman. CAPTAIN TAKING OFF **HAT**.

The gardener went to the river with the bride/groom. GARDENER GETTING OUT OF **CANOE**.

The woman/she explored the cave with the king/queen. WOMAN DROPPING **CANDLE**.

The gladiator/he had a chat with the gentleman/lady. GLADIATOR DRIVING OFF (WITH A **CAR**).

The queen enjoyed a discussion with the cowboy/nanny. QUEEN PUTTING **CUP** UPSIDE DOWN.

The boy went to the race track with the wizard/witch. BOY GETTING OUT OFF **CAR**.

The mermaid left hospital with the policewoman/policeman. MERMAID GETTING OUT OF **WHEELCHAIR**.

The queen went for a walk with the prince/princess. QUEEN TAKING OFF **CROWN**.

The sheriff talked about politics with the groom/bride. SHERIFF STANDING UP FROM **ROCKING-CHAIR**.

The kitchenmaid had put out a fire with the queen/king. KITCHENMAID PUTTING **FIRE-EXTINGUISHER** UPSIDE down.

The pirate escaped from jail with the lady/gentleman. PIRATE REMOVING **CHAIN**.

The gladiator went to the battleground with the countess/admiral. GLADIATOR DROPPING **SWORD**.

The lady discussed the weather with the mermaid/pirate. LADY STANDING UP FROM **CHAIR**.

The admiral was having a laugh with the princess/prince. ADMIRAL GETTING OFF **TABLE**.

The Viking went to the lake with the nanny/cowboy. VIKING EMPTYING **BUCKET**.

The girl was having fun with the witch/wizard. GIRL JUMPING OFF **FOUNTAIN**.

The prince went to the beach with the nun/priest. PRINCE STANDING DOWN FROM **TABLE**.

The woman was having a break with the pirate/mermaid. WOMAN FALLING OFF **SOFA**.

The farmer went to the village with the pilot/stewardess. FARMER GETTING OFF **BIKE**.

The countess toured the country with the girl/boy. COUNTESS DROPPING **CAMERA**.

Experiment 2

The mermaid was waiting for a taxi with the nanny. MERMAID STANDING FROM **WHEELCHAIR/**PUTTING UP HAND.

The captain was invited to the palace with the groom. CAPTAIN DROPPING **CUP/**BENDING OVER.

The admiral was searching for a treasure with the king. ADMIRAL DROPPING **CANDLE/**FALLING TO GROUND

The countess went for a walk with the nun. COUNTESS LOWERING **UMBRELLA/**TURNING AROUND.

The girl was having fun with the queen. GIRL GETTING OFF **DESK/**PUTTING UP BOTH HANDS.

The Viking went to the lake with the cowboy. VIKING EMPTYING **BASKET/**SITTING DOWN.

The sheriff talked about politics with the policeman. SHERIFF STANDING UP FROM **ROCKING-CHAIR/**TAKING OFF HAT.

The pirate argued about traffic with the gladiator. PIRATE GETTING OUT OF **CAR**/PUTING UP BOTH HANDS.

The kitchenmaid practiced for a fire drill with the queen. KITCHENMAID TURNING **FIRE-EXTINGUISHER** UPSIDE DOWN/WALKING AWAY.

The cowboy visited the castle with the gentleman. COWBOY GETTING OFF **HORSE**/TAKING OFF HAT

The bride investigated a cave with the witch. BRIDE DROPPING **CANDLE**/FALLING TO GROUND.

The woman was in a pub with the mermaid. WOMAN GETTING OFF **TABLE**/PUTTING UP HAND.

The gladiator escaped from jail with the gentleman. GLADIATOR REMOVING **CHAIN**/LYING DOWN.

The Indian went to the forest with the king. INDIAN SHOOTING WITH **GUN**/TURNING AROUND.

The queen cleaned the windows with the princess. QUEEN HOLDING **BRUSH** IN BOTH HANDS/WALKING AWAY.

The king was waiting for a carriage with the pirate. KING STANDING UP FROM **WHEELCHAIR**/PUTTING UP HAND.

The gardener went to the village with the pilot. GLADIATOR GETTING OFF **BIKE**/TAKING OFF THE HAT.

The stewardess was hiking in the hills with the princess. STEWARDESS DROPPING **CAMERA**/LYING DOWN.

The boy quarreled about traffic with the wizard. BOY GETTING OUT OF **CAR**/PUT UP BOTH HANDS.

The nun was looking for a watch with the kitchenmaid. NUN DROPPING **CUP/**BENDING OVER.

The gardener was having a laugh with the prince. GARDENER GETTING OFF **DESK /**PUTTING UP BOTH HANDS.

The lady discussed the weather with the policewoman. LADY STANDING UP FROM **CHAIR/**TAKING OFF HAT.

The prince was in a cafe with the priest. PRINCE GETTING OFF **TABLE/**PUTTING UP HAND.

The woman visited a garden with the girl. WOMAN DROPPING **ICE CREAM/**SITTING DOWN.

Appendix 5: Results from logit mixed-effects modelling (Ch 4. Affordances)

	Estimate	SE of estimate	*z*	*p*
Experiment 1				
(excluding repairs)				
ambiguity	-1.0968	0.1467	-7.477	<.001
situational congruence	-0.804	0.1358	-5.922	<.001
ambiguity*situational congruence	0.1454	0.1231	1.181	.238
congruence effect for ambiguous condition	2.0235	0.3604	5.615	<.001
congruence effect for unambiguous condition	1.1216	0.2772	4.046	<.001
(including repairs)				
ambiguity	-0.982	0.108	-9.096	<.001
situational congruence	-0.644	0.105	-6.12	<.001
ambiguity*situational congruence	0.088	0.103	0.856	.392
Experiment 2				
(excluding repairs)				
action	-0.013	0.146	-0.092	.927
situational congruence	0.965	0.159	6.052	<.001
action*situational congruence	0.478	0.148	3.241	.001
congruence effect for related action	2.9569	0.565	5.236	<.001
congruence effect for unrelated action	1.136	0.516	2.200	.028
(including repairs)				
action	-0.01747	0.129	-0.135	.893
situational congruence	0.79785	0.136	5.858	<.001
action* situational congruence	-0.26865	0.129	-2.08	.038
congruence effect for related action	2.1247	0.385	5.525	<.001
congruence effect for unrelated action	1.0516	0.365	2.881	.004

Appendix 6: Experimental materials (Ch 5. Addressee's discourse model)

Context sentences events depicted in the target pictures (in capitals). As for the second context sentence, the first version represents the referent-mentioned condition and the second version the competitor-mentioned condition.

The Viking is fishing in the lake with the nanny. She is lying down./He is lying down. NANNY PUTTING BUCKET UPSIDE DOWN

The mermaid is waiting for a taxi with the admiral. He is sitting in a wheelchair./She is sitting on a bench. ADMIRAL GETTING OFF WHEELCHAIR

The Indian is on the run with the lady. She is carrying a bag./He is carrying a bag. LADY HOLING CHAIN UP

The witch is taking a walk with the priest. He is holding an umbrella./She is holding a stick. PRIEST TURNING AROUND

The wizard has cleaned the windows with the princess. She is holding a bucket./He is holding a bucket. PRINCE SITTING DOWN.

The girl is having fun with the king. He is standing on a chest./She is standing on a chest. KING RAISING HIS MEGAPHONE

The cowboy is approaching a castle with the policewoman. She is wearing a hat./He is wearing a hat. POLICEWOMAN GETTING OFF HORSE

The gladiator is on the battleground with the countess. She is wearing a dress./He is wearing a helmet. COUNTESS RAISING SWORD

The lady is discussing the weather with the policeman. He is standing next to a tree./She is standing next to a tree. POLICEMAN RAISING HAND

The nanny is having a picnic with the prince. He is lying on the ground./She is lying on the ground. PRINCE STANDING UP

The maid has arrived at a park with the cowboy. He has got a gun./She has got a spoon. COWBOY PUTTING HAND INTO THE FOUNTAIN

The king is talking about politics with the nun. She is lying on the sofa./He is lying on the sofa. NUN BOWS

The policewoman is playing in a garden with the boy. He is wearing a blue shirt./She is wearing a white vest. BOY DROPS ICE CREAM

The captain hurries to the station with the bride. She is holding a map./He is holding a map. BRIDE FALLS TO GROUND

The pilot is arguing about the traffic with the mermaid. She has blond hair./He has brown hair. MERMAID GOT OUT OF CAR

The admiral is searching for treasure with the queen. She is wearing a crown./He is wearing a hat. QUEEN DROPS CANDLE

The stewardess is visiting the village with the gladiator. He is looking back./She is looking back. THE GLADIATOR GETS OFF HORSE

The boy is quarrelling about a road sign with the witch. She is raising a stick in the air./He is raising a hand in the air. WITCH GOT INTO CAR

The countess is in the forest with the Indian. He has got a trumpet./She has got a trumpet. INDIAN SHOOTS

The sheriff is at the riverside with the girl. She is holding a balloon./He is holding a balloon. GIRL GETS INTO CANOE

The queen is hiking in the hills with the gentleman. He has got a suitcase./She has got a camera. GENTLEMAN SITS DOWN

The nun is pruning the roses with the wizard. He is wearing a gown./She is wearing a gown. WIZARD TURNS AROUND

The groom has practised for a fire drill with the maid. She has got a fire-extinguisher./He has got a hose. MAID TURNS FIRE-EXTINGUISHER UPSIDE DOWN

The woman is in a pub with the pirate. He is wearing a yellow jacket./She is wearing a yellow jacket. PIRATE RAISES ARM

Appendix 7: Results from logit mixed-effects modelling (Ch 5. Addressee's discourse model)

	Estimate	SE of estimate	*z*	*p*
Experiment 1				
target-shared vs. target-privileged	-0.707	0.520	-1.36	.174
target-privileged vs. competitor privileged	-2.075	0.408	-5.09	<.001
Experiment 2				
mention	-1.735	0.212	-8.191	<.001
sharedness	0.398	0.203	1.957	.050
mention*sharedness	-0.068	0.151	-0.451	.652

Appendix 8: Experimental materials (Ch 6. Animacy)

Experiment 1

The refugees affected the elections to some extent. Obviously, ...

The elections affected the refugees to some extent. Obviously, ...

The builders supported the cranes during the work. Occasionally, ...

The cranes supported the builders during the work. Occasionally, ...

The suspects revealed the stories at long last. Surprisingly, ...

The stories revealed the suspects at long last. Surprisingly, ...

The hikers carried the canoes a long way downstream. Sometimes, ...

The canoes carried the hikers a long way downstream. Sometimes, ...

The boys hit the balls very hard. Naturally, ...

The balls hit the boys very hard. Naturally, ...

The hillwalkers warmed the drinks after the walk. Suddenly, ...

The drinks warmed the hillwalkers after the walk. Suddenly, ...

The politicians influenced the finances quite strongly. Usually, ...

The finances influenced the politicians quite strongly. Usually, ...

The slaves transported the boats to the south. Remarkably, ...

The boats transported the slaves to the south. Remarkably, ...

The Eskimos carried the sledges for a long time. Eventually, ...

The sledges carried the Eskimos for a long time. Eventually, ...

The detectives followed the cars throughout the night. Eventually, ...

The cars followed the detectives throughout the night. Eventually, ...

The scientists needed the journals all the time. Clearly, ...

The journals needed the scientists all the time. Clearly, ...

The customers pushed the doors all of a sudden. Fortunately, ...

The doors pushed the customers all of a sudden. Fortunately, ...

The knights protected the castles from any danger. Obviously, ...

The castles protected the knights from any danger. Obviously, ...

The invaders attacked the cannons all of a sudden. Clearly, ...

The cannons attacked the invaders all of a sudden. Clearly, ...

The terrorists changed the agreements quite noticeably. Naturally, ...

The agreements changed the terrorists quite noticeably. Naturally, ...

The casualties reached the ships by the afternoon. Apparently, ...

The ships reached the casualties by the afternoon. Apparently, ...

The miners crushed the rocks with immense force. Undoubtedly, ...

The rocks crushed the miners with immense force. Undoubtedly, ...

The pilots endangered the planes quite seriously. Clearly, ...

The planes endangered the pilots quite seriously. Clearly, ...

The stuntmen held the chains until the end. Usually, ...

The chains held the stuntmen until the end. Usually, ...

The doormen nudged the gates a bit. Unexpectedly, ...

The gates nudged the doormen a bit. Unexpectedly, ...

The immigrants affected the policies a great deal. Apparently, ...

The policies affected the immigrants a great deal. Apparently, ...

The painters supported the ladders during the work. Sometimes, ...

The ladders supported the painters during the work. Sometimes, ...

The youngsters knocked down the motorbikes last night. Fortunately, ...

The motorbikes knocked down the youngsters last night. Fortunately, ...

The hunters surrounded the fires at night. Apparently, ...

The fires surrounded the hunters at night. Apparently, ...

The tourists passed the trams after all. Apparently, ...

The trams passed the tourists after all. Apparently, ...

The residents influenced the decisions quite clearly. Apparently, ...

The decisions influenced the residents quite clearly. Apparently, ...

The villagers needed the shops during the week. Obviously, ...

The shops needed the villagers during the week. Obviously, ...

The workers replaced the machines in the end. Unfortunately, ...

The machines replaced the workers in the end. Unfortunately, ...

The villagers protected the dykes during the storm. Surprisingly, ...

The dykes protected the villagers during the storm. Surprisingly, ...

The warriors resembled the statues from a distance. Usually, ...

The statues resembled the warriors from a distance. Usually, ...

The sailors overtook the yachts in the end. Clearly, ...

The yachts overtook the sailors in the end. Clearly, ...

The rebels attacked the tanks the following day. Apparently, ...

The tanks attacked the rebels the following day. Apparently, ...

The soldiers transported the jeeps in the dark. Suddenly, ...

The jeeps transported the soldiers in the dark. Suddenly, ...

The rescuers reached the helicopters within an hour. Obviously, ...

The helicopters reached the rescuers within an hour. Obviously, ...

The cowboys surrounded the wagons before dawn. Suddenly, ...

The wagons surrounded the cowboys before dawn. Suddenly, ...

The climbers held the ropes during the abseil. Obviously, ...

The ropes held the climbers during the abseil. Obviously, ...

The girls hid the boxes during the raid. Suddenly, ...

The boxes hid the girls during the raid. Suddenly, ...

The applicants satisfied the conditions in the end. Certainly, ...

The conditions satisfied the applicants in most cases. Certainly, ...

The executives changed the salaries a great deal. Inevitably, ...

The salaries changed the executives a great deal. Inevitably, ...

The players sponsored the clubs in the past. Occasionally, ...

The clubs sponsored the players in the past. Occasionally, ...

Experiment 2

The refugees affected the politicians to some extent. Obviously, ...

The refugees affected the policies to some extent. Obviously, ...

The elections affected the politicians to some extent. Obviously, ...

The elections affected the policies to some extent. Obviously, ...

The outlaws surrounded the hunters during the night. Apparently, ...

The outlaws surrounded the huts during the night. Apparently, ...

The tents surrounded the hunters during the night. Apparently, ...

The tents surrounded the huts during the night. Apparently, ...

The Eskimos carried the children almost all day. Eventually, ...

The Eskimos carried the sledges almost all day. Eventually, ...

The skimobiles carried the children almost all day. Eventually, ...

The skimobiles carried the sledges almost all day. Eventually, ...

The knights protected the villagers from any danger. Obviously, ...

The knights protected the castles from any danger. Obviously, ...

The forts protected the villagers from any danger. Obviously, ...

The forts protected the castles from any danger. Obviously, ...

The tourists passed the protesters a couple of times. Apparently, ...

The tourists passed the buses a couple of times. Apparently, ...

The trams passed the protesters a couple of times. Apparently, ...

The trams passed the buses a couple of times. Apparently, ...

The terrorists changed the residents quite considerably. Naturally, ...

The terrorists changed the agreements quite considerably. Naturally, ...

The negotiations changed the residents quite considerably. Naturally, ...

The negotiations changed the agreements quite considerably. Naturally, ...

The drivers hit the cyclists by accident. Undoubtedly, ...

The drivers hit the vehicles by accident. Undoubtedly, ...

The tractors hit the cyclists by accident. Undoubtedly, ...

The tractors hit the vehicles by accident. Undoubtedly, ...

The sailors followed the divers for the whole day. Obviously, ...

The sailors followed the steamboats for the whole day. Obviously, ...

The ships followed the divers for the whole day. Obviously, ...

The ships followed the steamboats for the whole day. Obviously, ...

The newsreaders mentioned the celebrities yesterday. Clearly, ...

The newsreaders mentioned the magazines yesterday. Clearly, ...

The tabloids mentioned the celebrities yesterday. Clearly, ...

The tabloids mentioned the magazines yesterday. Clearly, ...

The millionaires supported the artists in the past. Apparently, ...

The millionaires supported the projects in the past. Apparently, ...

The schemes supported the artists in the past. Apparently, ...

The schemes supported the projects in the past. Apparently, ...

The hooligans influenced the councillors quite clearly. Apparently, ...

The hooligans influenced the decisions quite clearly. Apparently, ...

The plans influenced the councillors quite clearly. Apparently, ...

The plans influenced the decisions quite clearly. Apparently, ...

The invaders attacked the soldiers all of a sudden. Clearly, ...

The invaders attacked the submarines all of a sudden. Clearly, ...

The battleships attacked the soldiers all of a sudden. Clearly, ...

The battleships attacked the submarines all of a sudden. Clearly, ...

The managers replaced the workers in the end. Clearly, ...

The managers replaced the machines in the end. Clearly, ...

The computers replaced the workers in the end. Clearly, ...

The computers replaced the machines in the end. Clearly, ...

The rescuers carried the mountaineers a long way downstream. Presumably, ...

The rescuers carried the canoes a long way downstream. Presumably, ...

The rafts carried the mountaineers a long way downstream. Presumably, ...

The rafts carried the canoes a long way downstream. Presumably, ...

The suspects mentioned the fraudsters many times. Surprisingly, ...

The suspects mentioned the reports many times. Surprisingly, ...

The newspapers mentioned the fraudsters many times. Surprisingly, ...

The newspapers mentioned the reports many times. Surprisingly, ...

The paramedics reached the boys in time. Remarkably, ...

The paramedics reached the cars in time. Remarkably, ...

The ambulances reached the boys in time. Remarkably, ...

The ambulances reached the cars in time. Remarkably, ...

The rowers overtook the swimmers in the end. Clearly, ...

The rowers overtook the yachts in the end. Clearly, ...

The boats overtook the swimmers in the end. Clearly, ...

The boats overtook the yachts in the end. Clearly, ...

The detectives followed the teenagers throughout the night. Eventually, ...

The detectives followed the lorries throughout the night. Eventually, ...

The sportscars followed the teenagers throughout the night. Eventually, ...

The sportscars followed the lorries throughout the night. Eventually, ...

The hikers held the climbers during the abseil. Suddenly, ...

The hikers held the ropes during the abseil. Suddenly, ...

The chains held the climbers during the abseil. Suddenly, ...

The chains held the ropes during the abseil. Suddenly, ...

The pilots endangered the passengers quite seriously. Clearly, ...

The pilots endangered the planes quite seriously. Clearly, ...

The helicopters endangered the passengers quite seriously. Clearly, ...

The helicopters endangered the planes quite seriously. Clearly, ...

The lawyers described the prisoners in much detail. Undoubtedly, ...

The lawyers described the forms in much detail. Undoubtedly, ...

The documents described the prisoners in much detail. Undoubtedly, ...

The documents described the forms in much detail. Undoubtedly, ...

The rebels attacked the guards the following day. Apparently, ...

The rebels attacked the jeeps the following day. Apparently, ...

The tanks attacked the guards the following day. Apparently, ...

The tanks attacked the jeeps the following day. Apparently, ...

The warriors transported the slaves to the south. Remarkably, ...

The warriors transported the lifeboats to the south. Remarkably, ...

The warships transported the slaves to the south. Remarkably, ...

The warships transported the lifeboats to the south. Remarkably, ...

The Indians surrounded the cowboys before dawn. Obviously, ...

The Indians surrounded the carts before dawn. Obviously, ...

The wagons surrounded the cowboys before dawn. Obviously, ...

The wagons surrounded the carts before dawn. Obviously, ...

Experiment 3

The refugee(s) affected the politician(s) to some extent. Obviously, ...

The refugee(s) affected the policy (policies) to some extent. Obviously, ...

The election(s) affected the politician(s) to some extent. Obviously, ...

The election(s) affected the policy (policies) to some extent. Obviously, ...

The Eskimo(s) carried the child (children) almost all day. Eventually, ...

The Eskimo(s) carried the sledge(s) almost all day. Eventually, ...

The snowmobile(s) carried the child (children) almost all day. Eventually, ...

The snowmobile(s) carried the sledge(s) almost all day. Eventually, ...

The knight(s) protected the villager(s) from any danger. Obviously, ...

The knight(s) protected the castle(s) from any danger. Obviously, ...

The fort(s) protected the villager(s) from any danger. Obviously, ...

The fort(s) protected the castle(s) from any danger. Obviously, ...

The tourist(s) passed the protester(s) a couple of times. Apparently, ...

The tourist(s) passed the bus (buses) a couple of times. Apparently, ...

The tram(s) passed the protester(s) a couple of times. Apparently, ...

The tram(s) passed the bus (buses) a couple of times. Apparently, ...

The driver(s) hit the cyclist(s) by accident. Undoubtedly, ...

The driver(s) hit the vehicle(s) by accident. Undoubtedly, ...

The tractor(s) hit the cyclist(s) by accident. Undoubtedly, ...

The tractor(s) hit the vehicle(s) by accident. Undoubtedly, ...

The sailor(s) followed the diver(s) for the whole day. Obviously, ...

The sailor(s) followed the steamboat(s) for the whole day. Obviously, ...

The ship(s) followed the diver(s) for the whole day. Obviously, ...

The ship(s) followed the steamboat(s) for the whole day. Obviously, ...

The newsreader(s) mentioned the celebrity (celebrities) yesterday. Clearly, ...

The newsreader(s) mentioned the magazine(s) yesterday. Clearly, ...

The tabloid(s) mentioned the celebrity (celebrities) yesterday. Clearly, ...

The tabloid(s) mentioned the magazine(s) yesterday. Clearly, ...

The millionaire(s) supported the artist(s) in the past. Apparently, ...

The millionaire(s) supported the project(s) in the past. Apparently, ...

The scheme(s) supported the artist(s) in the past. Apparently, ...

The scheme(s) supported the project(s) in the past. Apparently, ...

The hooligan(s) influenced the councillor(s) quite clearly. Apparently, ...

The hooligan(s) influenced the decision(s) quite clearly. Apparently, ...

The plan(s) influenced the councillor(s) quite clearly. Apparently, ...

The plan(s) influenced the decision(s) quite clearly. Apparently, ...

The manager(s) replaced the worker(s) in the end. Clearly, ...

The manager(s) replaced the machine(s) in the end. Clearly, ...

The computer(s) replaced the worker(s) in the end. Clearly, ...

The computer(s) replaced the machine(s) in the end. Clearly, ...

The suspect(s) mentioned the fraudster(s) many times. Surprisingly, ...

The suspect(s) mentioned the report(s) many times. Surprisingly, ...

The newspaper(s) mentioned the fraudster(s) many times. Surprisingly, ...

The newspaper(s) mentioned the report(s) many times. Surprisingly, ...

The paramedic(s) reached the boy(s) in time. Remarkably, ...

The paramedic(s) reached the car(s) in time. Remarkably, ...

The ambulance(s) reached the boy(s) in time. Remarkably, ...

The ambulance(s) reached the car(s) in time. Remarkably, ...

The rower(s) overtook the swimmer(s) in the end. Clearly, ...

The rower(s) overtook the yacht(s) in the end. Clearly, ...

The boat(s) overtook the swimmer(s) in the end. Clearly, ...

The boat(s) overtook the yacht(s) in the end. Clearly, ...

The detective(s) followed the teenager(s) throughout the night. Eventually, ...

The detective(s) followed the lorry(lorries) throughout the night. Eventually, ...

The sportscar(s) followed the teenager(s) throughout the night. Eventually, ...

The sportscar(s) followed the lorry(lorries) throughout the night. Eventually, ...

The hiker(s) held the climber(s) during the abseil. Suddenly, ...

The hiker(s) held the rope(s) during the abseil. Suddenly, ...

The chain(s) held the climber(s) during the abseil. Suddenly, ...

The chain(s) held the rope(s) during the abseil. Suddenly, ...

The pilot(s) endangered the passenger(s) quite seriously. Clearly, ...

The pilot(s) endangered the plane(s) quite seriously. Clearly, ...

The helicopter(s) endangered the passenger(s) quite seriously. Clearly, ...

The helicopter(s) endangered the plane(s) quite seriously. Clearly, ...

The lawyer(s) described the prisoner(s) in much detail. Undoubtedly, ...

The lawyer(s) described the form(s) in much detail. Undoubtedly, ...

The document(s) described the prisoner(s) in much detail. Undoubtedly, ...

The document(s) described the form(s) in much detail. Undoubtedly, ...

The rebel(s) attacked the guard(s) the following day. Apparently, ...

The rebel(s) attacked the jeep(s) the following day. Apparently, ...

The tank(s) attacked the guard(s) the following day. Apparently, ...

The tank(s) attacked the jeep(s) the following day. Apparently, ...

The warrior(s) transported the slave(s) to the south. Remarkably, ...

The warrior(s) transported the lifeboat(s) to the south. Remarkably, ...

The warship(s) transported the slave(s) to the south. Remarkably, ...

The warship(s) transported the lifeboat(s) to the south. Remarkably, ...

Experiment 3a only

The outlaws surrounded the hunter during the night. Apparently, ...

The outlaws surrounded the hut during the night. Apparently, ...

The tents surrounded the hunter during the night. Apparently, ...

The tents surrounded the hut during the night. Apparently, ...

The terrorists changed the resident quite considerably. Naturally, ...

The terrorists changed the agreement quite considerably. Naturally, ...

The negotiations changed the resident quite considerably. Naturally, ...

The negotiations changed the agreement quite considerably. Naturally, ...

The invaders attacked the soldier all of a sudden. Clearly, ...

The invaders attacked the submarine all of a sudden. Clearly, ...

The battleships attacked the soldier all of a sudden. Clearly, ...

The battleships attacked the submarine all of a sudden. Clearly, ...

The gladiators dragged the slave into the middle of the square. Presumably, ...

The gladiators dragged the cart into the middle of the square. Presumably, ...

The chariots dragged the slave into the middle of the square. Presumably, ...

The chariots dragged the cart into the middle of the square. Presumably, ...

The Indians surrounded the cowboy before dawn. Obviously, ...

The Indians surrounded the cart before dawn. Obviously, ...

The wagons surrounded the cowboy before dawn. Obviously, ...

The wagons surrounded the cart before dawn. Obviously, ...

Experiment 3b only

The general defended the citizens during the war. Apparently, ...

The general defended the explosives during the war. Apparently, ...

The cannon defended the citizens during the war. Apparently, ...

The cannon defended the explosives during the war. Apparently, ...

The terrorist changed the residents quite considerably. Naturally, ...

The terrorist changed the agreements quite considerably. Naturally, ...

The debate changed the residents quite considerably. Naturally, ...

The debate changed the agreements quite considerably. Naturally, ...

The captain attacked the soldiers all of a sudden. Clearly, ...

The captain attacked the submarines all of a sudden. Clearly, ...

The battleship attacked the soldiers all of a sudden. Clearly, ...

The battleship attacked the submarines all of a sudden. Clearly, ...

The rescuer carried the mountaineers a long way downstream. Presumably, ...

The rescuer carried the canoes a long way downstream. Presumably, ...

The raft carried the mountaineers a long way downstream. Presumably, ...

The raft carried the canoes a long way downstream. Presumably, ...

The Indian reached the cowboys before dawn. Obviously, ...

The Indian reached the wagons before dawn. Obviously, ...

The carriage reached the cowboys before dawn. Obviously, ...

The carriage reached the wagons before dawn. Obviously, ...

Appendix 9: Results from logit mixed-effects modelling (Ch 6. Animacy)

	Estimate	SE of estimate	*z*	*p*
Experiment 1a				
antecedent position	-0.967	0.131	-7.383	<.001
animacy	0.762	0.130	5.843	<.001
antecedent position*animacy	-0.347	0.127	-2.733	.006
Experiment 1b				
antecedent position	-0.641	0.080	-7.978	<.001
animacy	0.716	0.081	8.813	<.001
antecedent position*animacy	-0.098	0.078	-1.249	.212
Experiment 2				
referent animacy (A)	-0.389	0.069	-5.662	<.001
competitor animacy (C)	0.102	0.068	1.504	.132
antecedent position (P)	-0.976	0.260	-3.752	<.001
A*C	-0.186	0.068	-2.739	.006
A*P	0.039	0.069	0.570	.569
C*P	-0.029	0.068	-0.423	.672
A*C*P	-0.043	0.068	-0.629	.530
C effect for animate referent	0.541	0.266	2.033	.042
C effect for inanimate referent	-0.031	0.246	-0.127	.899
Experiment 3				
referent animacy (A)	-0.730	0.079	-9.231	<.001
competitor animacy (C)	0.011	0.088	0.127	.899
antecedent position (P)	-1.344	0.297	-4.521	<.001
A*C	-0.170	0.076	-2.23	.026
A*P	0.076	0.079	0.958	.338
C*P	-0.112	0.088	-1.271	.204
A*C*P	-0.026	0.076	-0.34	.734
C effect for animate referent	0.970	0.387	2.509	.012
C effect for inanimate referent	0.202	0.302	0.67	.503

Appendix 10: End-of-study visit report of the Finnish experiment submitted to EPS

The effect of gender in a non-gender marking language

Kumiko Fukumura
University of Dundee
k.fukumura@dundee.ac.uk

Study undertaken at Turku University, Finland

Abstract

We examined the effect of gender on the production of pronouns in Finnish. Past research has shown that English speakers use fewer pronouns when the context includes two entities that have the same gender than a different gender. One possibility is that this effect is driven by ambiguity avoidance, because in English, pronouns are ambiguous in a context with a same-gender competitor, but not with a different-gender competitor. That is, the effect is specific to gender-marking languages. A different possibility is that a same-gender competitor increases semantic competition, which reduces the referent's activation and hence the frequency of pronoun use relative to a context with a different-gender competitor (Arnold & Griffin, 2007). We explored these two hypotheses by testing native speakers of Finnish, which, unlike many European languages, does not encode gender in pronouns. The results showed that Finnish speakers produced fewer pronouns in the same-gender than in the different-gender competitor condition, providing support for the view that gender affects semantic competition rather than that it is exclusively due to ambiguity avoidance.

APPENDICES

Acknowledgements

I deeply thank Dr. Jukka Hyönä, who made this visit possible and was an excellent host. I also cannot thank Merete Juntuken enough for her help and dedication to this study in translating the materials, recruiting participants, taking part in all the experiments as an experimenter, and helping me with scoring. Without their help, this study would have been extremely difficult. I also thank Dr. Raymond Bertram, Dr. Johanna Kaakinen, and other people in the Department of Psychology at Turku University for their discussions and friendship during my stay.

Introduction

Different languages encode different information in referring expressions. In English, the referent's biological gender is one of the properties that constrains the form of pronoun (*he* vs. *she*), whereas in non-gender marking languages such as Finnish, gender is not encoded in pronouns, so the same pronoun is used for both male and female entities. An interesting question is how differences in the linguistic system affect the ways in which people perceive or attend to the properties of the entities they refer to.

We addressed this issue by examining the role of gender in the choice of pronouns over definite noun phrases in Finnish. In English, people reduce pronoun use when the referential context includes an additional entity (competitor) that has the same gender as the referent compared to when the competitor has a different gender (Arnold & Griffin, 2007; Fukumura, Van Gompel, & Pickering, 2010). An obvious reason for this is that in English, a pronoun is ambiguous in a context with a same-gender competitor, but not in a context with a different-gender competitor. That is, people avoid pronouns to avoid gender ambiguity. This suggests that the

competitor's gender should have no effect on referential choice in a language where gender is not expressed in pronouns and hence does not affect ambiguity. We call this the *ambiguity avoidance hypothesis*, which assumes that the gender effect is language specific.

However, Arnold and Griffin (2007) suggested that the gender effect is not due to ambiguity avoidance, but due to semantic competition. Pronoun use is reduced when the competitor has the same sex as the referent, because it is semantically more similar to the referent than a different-gender competitor and hence competes more strongly for activation. This reduces the referent's level of activation and pronoun use. Therefore, the gender effect should arise regardless of ambiguity and occur in a language such as Finnish, where pronouns are not gender marked. We call this the *semantic competition hypothesis*. It claims the gender effect is not language-specific.

We thus investigated whether Finnish speakers reduce the use of the third person singular pronoun *hän* ("he/she") depending on the competitor's gender. The pronoun *hän* does not encode the referent's gender. According to the ambiguity avoidance hypothesis, the choice of pronouns over definite NPs should not be affected by the competitor's gender in Finnish, because the competitor's gender does not affect the ambiguity of the pronoun; in fact, pronouns are always ambiguous when the referential context involves more than one potential referent, regardless of the competitor's gender. In contrast, the semantic competition hypothesis predicts that the competitor's gender should affect pronoun use even in Finnish, because it affects semantic similarity between the entities and therefore influences the referent's level of activation.

To investigate the effect of gender on Finnish pronouns, we used the same method as in Fukumura and Van Gompel (2008) and examined how participants refer back to the first-mentioned subject in (1) (*kuningas*, the king), when the oblique object had either the same gender (*lentäjän*, the pilot) or different gender (*lentoemännän*, the stewardess) from the referent.

(1) Kuningas vieraili linnassa lentäjän / lentoemännän kanssa.

(The king visited the castle with the pilot/stewardess.)

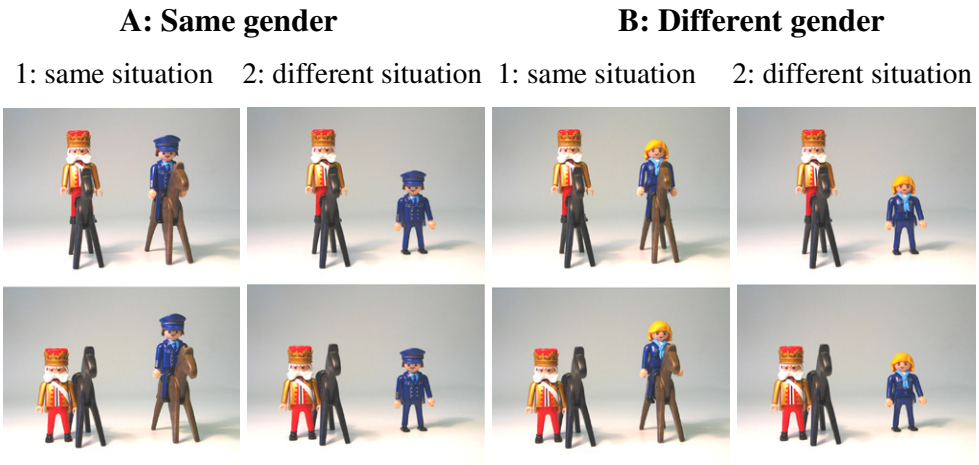

Figure 1. Example pictures in the same gender and different gender conditions for both the same situation and different situation conditions (Finnish study)

In each trial, a participant and a confederate saw a picture of the referent with either a same-gender or different-gender competitor (Figure 1, top panels) on their computer screens. The confederate put the toys on the table. Next, the participant read aloud the context sentence (1). Then a second picture appeared (bottom panels), and the participant described the referent's action to the confederate (e.g., *The king gets off the horse/He gets off the horse*), who had to act out the description using the

toys. In addition to the competitor's gender, we manipulated the competitor's affordances. In the same-situation conditions (A1 & A2), the competitor was in the same situation as the referent (both were on a horse), so both afforded the target action depicted in the second panel. In the different-situation conditions (B1 & B2), however, only the referent was on a horse, so the competitor could not get off a horse. Previous research has shown that English speakers reduce pronoun use when the competitor afforded the same action compared to when it did not (Fukumura & Van Gompel, 2008). A similar effect in Finnish would suggest that Finnish speakers use similar information when choosing referring expressions. An absence of a gender effect would therefore be all the more striking, suggesting that it is due to the difference in gender marking between Finnish and English.

Method

Participants. Thirty-five undergraduate students were recruited from universities in the city of Turku. They were all native speakers of Finnish, who were reported to be non-bilinguals, aged below 30 and not dyslexic. Data from one participant, who reported in our post-experimental questionnaire to have received his primary education in English, were replaced by data from another participant. We also excluded two participants who produced neither pronouns (*hän*) nor repeated NPs in over 40% of all experimental trials. Thus, data from 32 participants were analysed.

Materials. We used the same 24 experimental and 30 filler items as we had used in an English version of this experiment (Fukumura & Van Gompel, 2008). Each item set consisted of a context sentence and visual stimuli. All context sentences were translated from English into Finnish. In each context sentence, the

referent was a subject in sentence-initial position (the king) and the competitor an oblique object in a prepositional kanssa phrase. In the *same gender* condition, the competitor had the same gender as the referent (e.g., *pilot* when the referent was *king*), whereas in the *different gender* condition, it had a different gender (e.g., *stewardess*). We used past tense throughout.

The visual stimuli involved two photographs. Figures A1 & A2 represent the same gender conditions, and Figures B1 & B2 the different gender conditions. In both conditions, the characters were either in the *same situation* (A1 & B1), where both characters afforded the action carried out by the referent in the second panel (e.g., both are on a horse in the first panel, so both can be the agent of the action performed in the second panel), or in a *different situation* (A2 & B2), in which only the referent afforded the action carried out in the second panel (e.g., the referent is on the horse but the competitor is standing). The bottom half of each panel depicted the referent's subsequent action (e.g., getting off the horse). The positions of the referent and the competitor characters were counterbalanced between items. Most experimental characters had gender unambiguous roles (such as a king or a queen), and where they did not, their appearance indicated their gender (e.g., a bearded farmer). In addition, we constructed four practice items and 30 filler items, which were presented in the same way as the experimental items.

Procedure. The procedure was exactly the same as in an English version of this experiment, except that all the instructions were provided in Finnish. Before the experiment, the experimenter, who was a native speaker of Finnish, briefly explained the tasks involved in the experiment, and told both the participant and the confederate that the experiment investigated how people communicate verbally when they cannot see each other. The experimenter treated the confederate as a

genuine participant throughout, and our post-experimental questionnaire showed no evidence that participants realized that the confederate was not a real participant. The participant and the confederate drew lots to determine who was the speaker and the listener, but the experimenter ensured that the participant always got the speaker role.

During the experiment, the participant and the confederate sat side-by-side at a table, each facing a computer screen. A board between the participant and the confederate prevented them from seeing each other. At the beginning of each trial, both the participant and the confederate saw a photograph of miniature toy characters on their screen. The confederate received the toys from the experimenter and laid them out on the table as depicted in the photograph. The participant then pressed a computer mouse key to proceed, which triggered the presentation of a context sentence below the first photo on the participant's computer screen (the confederate did not see this sentence or the following photo). The participant read aloud the context sentence and pressed a key. The sentence was then replaced by a second photo appearing below the first picture. The participant described the photo to the confederate, who then had to act out the descriptions using the toys. The participant indicated whether the confederate carried out the action they intended by pressing the yes or no button. In the situation where participants produced pronouns in the presence of two characters, the confederate always picked up the referent character. But apart from this, the confederate always followed the participant's description literally (i.e., the confederate acted out the exact action that was described by the participant). The context sentence and the two photos were presented on the screens using DMDX software (Forster & Forster, 2003), and we recorded each participant's speech on a MiniDisk. Each session took around 45 minutes.

Design. The referent and competitor had either the same or a different gender, and they were either in the same or different situation. This resulted in a 2 (ambiguity: same gender vs. different gender) x 2 (situation: same situation vs. different situation) repeated measures design. Together with the 30 filler items, the 24 sets of experimental items were distributed across four lists. Each list had six experimental items in each of the four ambiguity x situation conditions, with one version of each item occurring in each list. Eight participants were randomly assigned to each list. The items of each list were presented in a fixed quasi-random order, with the constraint that the same character did not appear in two consecutive items.

Scoring. We scored whether participants produced a pronoun (*hän*) or a repeated noun phrase in cases where they referred to the referent character as the subject in the first clause they produced. We excluded 29 trials where participants did not refer to the target referent (e.g., *the horse* in Figure 1), seven trials where they used non-target expressions (e.g., The Finnish equivalent of *The man with the yellow hat* instead of *the farmer*), one trial where the participant referred to both characters (e.g., using the Finnish equivalent of *both*), and 12 trials where participants replaced their initial choice of expression (from a pronoun to a repeated noun phrase, e.g., *She ... the queen tipped her cup*, N = 1) (from a competitor's role name to the referent's role name, e.g., *The nun, sorry the countess puts the umbrella down*, N = 11), four trials where participants used the competitor's character role (e.g., the Finnish equivalent of *the pilot* rather than *the king* in Figure 1), and nine cases where they omitted the subject (…*and came down from the fountain*). In total, 8% (N = 62) of total responses (N = 768) were excluded from further analyses.

Results

Figure 2 presents the mean percentages of pronouns out of all pronoun and repeated noun phrase responses by condition. We conducted two ANOVAs on arcsin-transformed proportions of pronouns (Winer, 1971), one on the participant means with participants as the random variable (*F*1) and one on the item means with items as the random variable (*F*2). Gender ambiguity and situational context were treated as within-participants and -items variables and we also included participant/item list (I-IV) as a between-participants variable in the participant analysis and item list (I-IV) as a between-items variable in the item analysis in order to eliminate variance caused by random differences between groups (Pollatsek & Well, 1995).

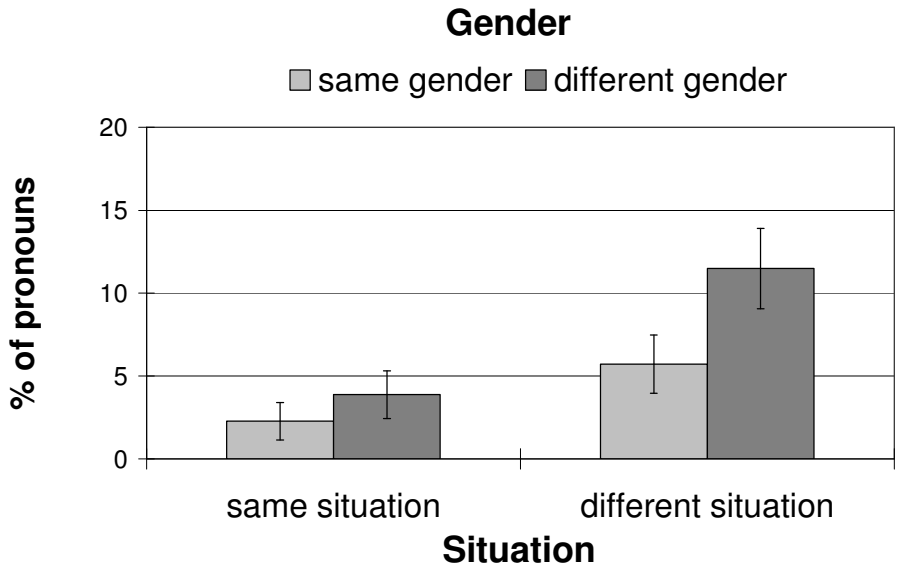

Figure 2. Mean percentages of pronouns out of all pronouns and repeated NPs

The analyses showed a significant main effect of gender, $F1(1, 28) = 8.21$, $p = .008$, $\eta_p^2 = .227$; $F2(1, 20) = 7.50$, $p = .013$, $\eta_p^2 = .273$. Participants produced significantly fewer pronouns when the competitor had the same gender as the

referent (3.9%) than when it had a different gender (7.4%). We also found an main effect of situation, $F1(1, 28) = 4.52$, $p = .042$, $\eta_p^2 = .140$; $F2(1, 20) = 12.31$, $p = .002$, $\eta_p^2 = .381$, with fewer pronouns in the same situation condition (2.7%) than in the different situation condition (8.6%). The interaction between the two factors was significant by participants, $F1(1, 28) = 4.39$, $p = .045$, $\eta_p^2 = .135$, but not by items; $F2(1, 20) = 2.69$, $p = .117$, $\eta_p^2 = .118$. This suggested that the effect of gender was larger in the different-situation than in the same-situation condition. Planned comparisons suggested that the effect of gender was significant in the different-situation condition, $F1(1, 28) = 8.21$, $p = .008$, $\eta_p^2 = . 227$; $F2(1, 20) = 5.64$, $p = .028$, $\eta_p^2 = .220$, but not in the same-situation condition, $F1(1, 28) = 1.32$, $p = .261$, $\eta_p^2 = . 045$; $F2(1, 20) = 1.40$, $p = .250$, $\eta_p^2 = .066$.

Furthermore, we analyzed substitution errors participants occasionally made. They were significantly more likely to use the competitor's role name (*The nun, sorry, the countess puts the umbrella down*) when the competitor's gender was the same (3.6%) as the referent's than otherwise (0.3%), $F1(1, 28) = 11.38$, $p = .002$, $\eta_p^2 = .289$; $F2(1, 20) = 6.2a$, $p = .022$, $\eta_p^2 = .237$. There was no effect of affordances, $F1(1, 28) = 1.05$, $p = .313$, $\eta_p^2 = .036$; $F2 < 1$, nor interaction between gender and affordances, $Fs < 1$.

Discussion

The results of our experiment showed that, as in English, gender affected pronoun use in Finnish. Finnish speakers produced fewer pronouns when the competitor had the same gender as the referent compared to when it had a different gender. We also found that Finnish speakers responded to affordances of the referential context by

producing fewer pronouns when the competitor afforded the same action than otherwise. This indicated that they were more explicit when the situation did not rule out the competitor as a referential candidate.

Because pronouns do not express gender in Finnish, the effect of gender cannot be due to ambiguity avoidance. Instead, the results supports the idea that the gender of discourse entities affects semantic competition: The higher conceptual similarity between the referent and competitor in the same-gender than in the different-gender condition caused stronger semantic competition in the same-gender condition, reducing the referent's activation and frequency of pronoun use.

Additional analyses suggested that gender also affected production errors. Participants were significantly more likely to use the competitor's role name when the competitor had the same gender as the referent than otherwise, indicating there was a stronger semantic interference in the same-gender than different-gender condition. Such interference may have occurred because the stronger semantic competition in the same gender condition resulted in stronger lexical competition during the production of definite noun phrases.

The effect of gender was modulated by the situation: The effect of gender was only significant in the different-situation condition. This was presumably because the overall frequency of Finnish pronouns was low, so when the situation did not disambiguate reference, the use of pronoun was close to floor level.

Together, the results provide novel evidence that gender results in semantic competition, which affects the choice of referring expressions. Regardless of whether gender is encoded in pronouns, the gender of the discourse entities affects the choice of referring expression.

Future research

I'm currently in touch with people in Åbo Akademi, a Swedish-speaking University in the city of Turku, Finland, to explore the possibility of running follow-up experiments. The first experiment would examine the effect of gender with Swedish-Finnish bilinguals who use Swedish as the dominant language but acquired Finnish at a very early age. As in English, Swedish pronouns express the referent's gender (*han* s. *hon*). One possibility is that because their dominant language encodes gender, Swedish-Finnish bilinguals pay more attention to an entity's gender when they speak in Finnish than native speakers of Finnish do. This predicts that the effect of gender should be larger with Swedish-Finnish bilinguals than with Finnish monolinguals. Alternatively, the semantic representations of the two languages may be separate (or the target language may determine what properties speakers attend while they speak), so the effect of gender may be the same regardless of the language background of the speaker. Depending on the results, further experiments would also examine the effect of gender on the use of Swedish pronouns by Swedish monolinguals and by Finnish-Swedish bilinguals.

References

Arnold, J. E., & Griffin, Z. M. (2007). The effect of additional characters on choice of referring expression: Everyone counts. *Journal of Memory and Language, 56*(4), 521-536.

Forster, K. I., & Forster, J. C. (2003). DMDX: A windows display program with millisecond accuracy. *Behavior Research Methods Instruments & Computers, 35*(1), 116-124.

Fukumura, K., Van Gompel, R.P.G., Pickering, M.J. *The use of visual context during the production of referring expressions* (under revision). *The Quarterly Journal of Experimental Psychology*.

Pollatsek, A., & Well, A. D. (1995). On the use of counterbalanced designs in cognitive research - a suggestion for a better and more powerful analysis. *Journal of Experimental Psychology-Learning Memory and Cognition, 21*(3), 785-794.

Winer, B. (1971). *Statistical principles in experimental design*. New York: McGraw-Hill Book Co.